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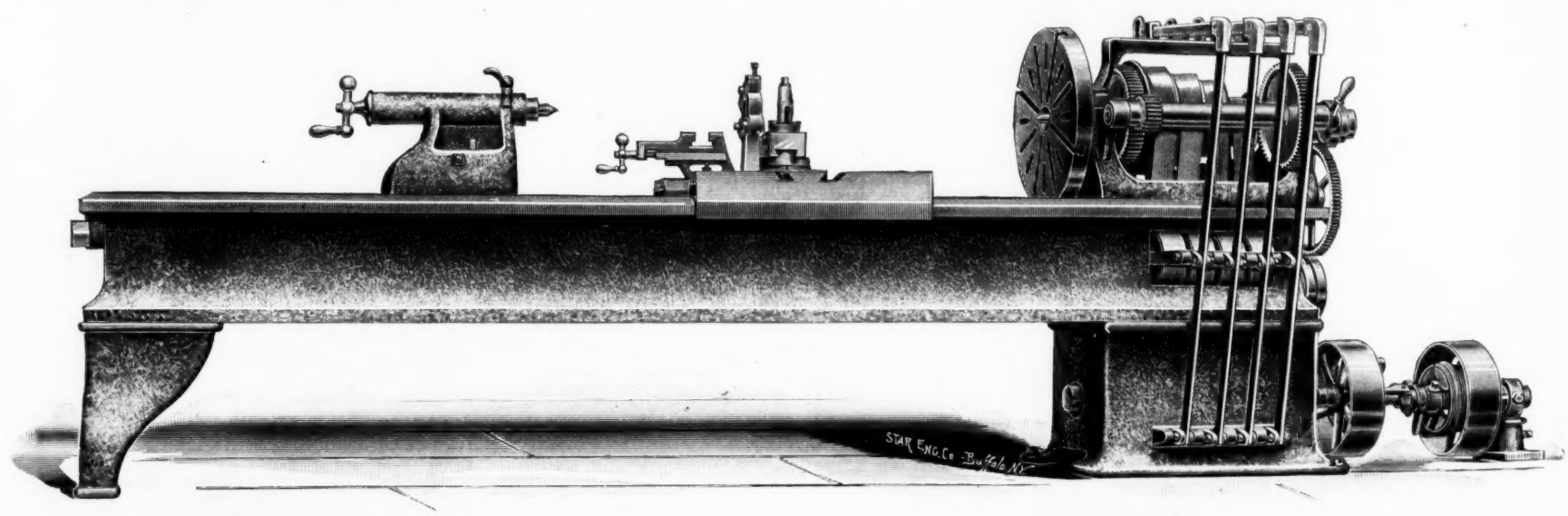
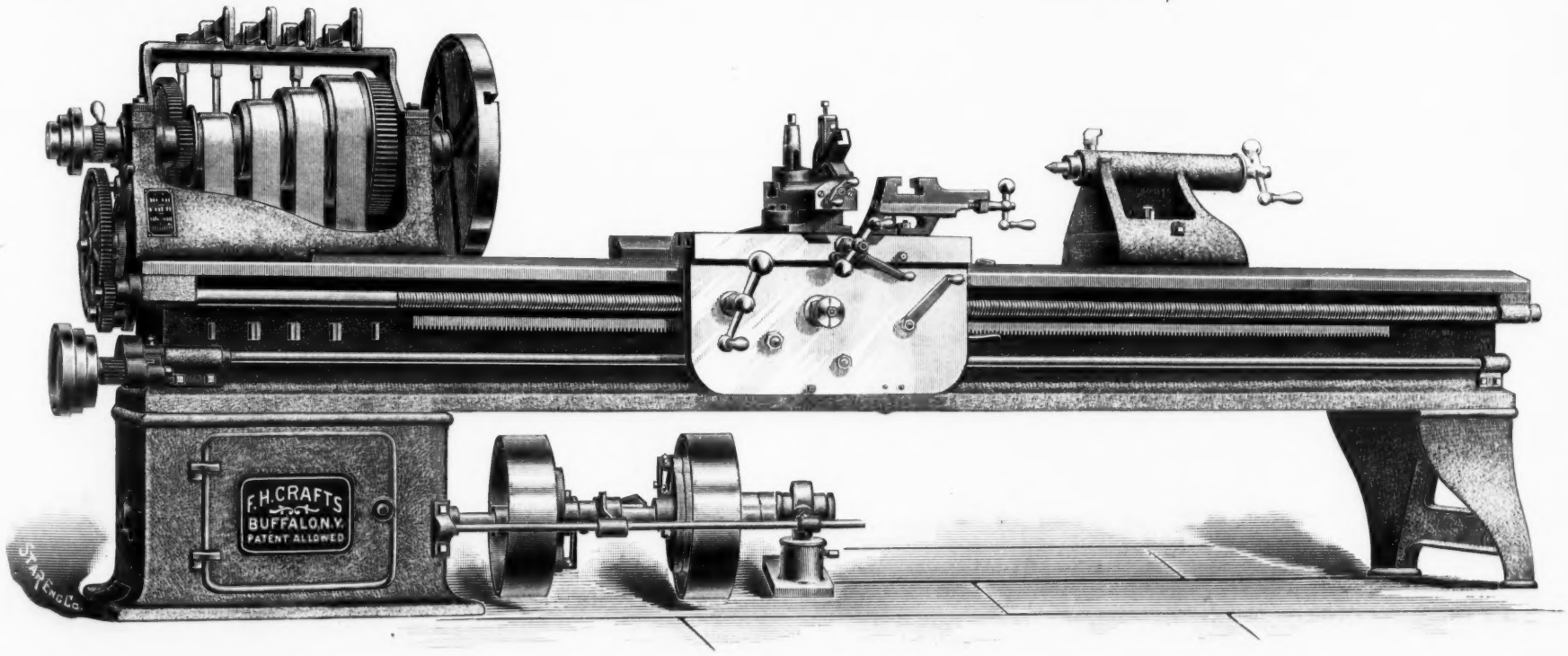
Crafts' Driving Device for Machine Tools.

The accompanying illustrations give a front and rear view of an engine lathe embracing a new driving device, the invention of Mr. F. H. Crafts, the senior member of the Buffalo Wood-working Machine Company, Buffalo, N. Y. This lathe was built by a leading Cincinnati machine tool builder for the purpose of testing Mr. Crafts' invention, and is now being used in the shops of Geo. Tifft, Sons & Co., of Buffalo.





CRAFTS' DRIVING DEVICE FOR MACHINE TOOLS.

How far the ordinary method of driving engine lathes is reversed in this lathe may be seen from the fact that instead of driving from overhead with one belt, as is the usual practice, the countershaft is placed directly underneath the spindle and each step of the cone is provided with a light, endless double belt (free from rivets). Thus a four-step cone has four belts, etc. Each belt is provided with a tightener by the use of which it is brought into action. These tighteners are controlled by a series of levers having notches planed in them at intervals of a half inch, so that any tension desired can be obtained, to suit the character of the work being done, the operation of the tighteners being to keep a belt, while driving, in contact with a greater arc of the cone, increasing thereby its driving capacity. When the belts are not in operation they are in a slack condition, which will undoubtedly prolong their lasting qualities. Of course the countershaft may be arranged to drive from overhead, but when driving from below, as shown, the pull is down, tending to keep the spindle seated in its bearings against upward thrust of the cutting tool, which is the reverse of the action of a belt driving from overhead.

We are informed by the inventor that this lathe has been, in operation, subjected to the criticism of machine tool experts both in Cincinnati and Buffalo, and that the manner of driving has received the highest approval; also that preliminary steps have been taken to build all sizes of lathes to be driven in this manner, as well as milling machines, cutting-off machines, drilling machines and various other machine tools.

The lathe here shown swings 22 inches over ways and 14 inches over carriage, and has a bed 12 feet in length; weight, 4,100 pounds. The spindle is of crucible steel, is hollow and runs in phosphor bronze bearings. The front journal is 3¼ inches diameter and 5⅝ inches in length; back journal, 2⅝ inches diameter and 4⅛ inches in length.

The feed belt is made endless and can be instantly tightened should it become slack. This is made possible by placing the feed cone on a stud, the plate carrying the stud being arranged to swing on the feed shaft. The cross-feed is quickly and simply adjusted, and when in use the table is firmly clamped to the ways by the operation of the lever shown in the cut.

Improved friction clutches are provided, being 14 inches diameter with 4-inch face.

It has come to be a fad the pressing of a button—while somebody or something does the rest—to start the engine that turns the wheels around in any enterprise of magnitude. It is a good deal more poetical than starting up by the ordinary process.

The Repairs to the Hull of the "Great Eastern" While Afloat.

It having been suggested to us that Mr. E. S. Renwick, a well-known engineer of this city, could give the readers of the AMERICAN MACHINIST a very interesting account of the repairs made on the "Great Eastern" while afloat in this port, we requested him to give us such an account, and have received from him the following graphic description, which, we have no doubt, will prove of interest:

The "Great Eastern" steamer was 680 feet long, 82 feet broad inside of the paddle boxes, and when loaded drew from 30 to 32 feet. She was therefore too large to get into the docks at Liverpool, and drew too much water to get to New York by way of the ship channel past Sandy Hook. Consequently she had to be loaded and unloaded at each port by means of lighters. The nearest place to New York at which she could lie was Flushing Bay, which she entered by way of Long Island Sound. On

the voyage during which the accident occurred to her, Montauk Point was made just as day broke, and the vessel was hove to awaiting a pilot. While lying to she drifted with the tide, and collided with a bunch of rocks, which was not then laid down on any chart. The collision was severe, and the ship took an immediate heavy list to port from the rapid entrance of water, but as the vessel was constructed with a double skin below the main deck, and the inner skin was uninjured, and as the manholes connecting the cells of this double skin with the interior of the ship had for that voyage been closed by manhole plates, and as the cells at opposite sides of the keel did not connect, the cellular space between the two skins of one side of the ship alone became filled with water, and the vessel was able to get to Flushing Bay and discharge her cargo.

A diver was employed to examine the bottom of the ship, and he reported a single fracture about eighty feet long, and from four to six feet broad. This fracture was at the turn of the bilge, about opposite the propeller engines and after coal bunkers, where the form of the ship changed most rapidly. The consignees employed Mr. Edward S. Renwick as engineer to repair the vessel, and associated with him his brother, Mr. Henry B. Renwick. They proposed that the repairs should be made by means of a caisson applied to the hull of the ship over the fracture. Under their directions a semi-cylindrical caisson was constructed 102 feet in length and 15 feet in breadth, with its gunwale curved transversely and longitudinally to fit the form of the ship. When the freight was discharged from the ship, the central line of the fracture was 27 feet below the water line, so that no measurement of the outside form of the ship could be made. To get the outside form of the ship, the coal was removed from the after coal bunkers next the fracture, and molds or templates were made from the inner skin. These molds were taken to the molding floor of a shipyard, and from them the lines of the inner skin were determined. The addition to these lines of the distance between the two skins gave the form of the lines of the outside of the hull, and from these new templates were made by which the form of the gunwale of the caisson was determined.

The joint between the caisson and the hull of the ship had to be made water tight to enable the caisson to be pumped out, and as it was not even presumable that the form of the gunwale of the caisson could be fitted exactly to the form of the hull, it became necessary to devise some form of packing which would accommodate itself to variations in the seam between the caisson and the hull, and which also would yield to pressure as the caisson was pumped out, and the pressure of the average head of 27 feet of water on its exterior would force it against the hull. The engineers devised for this packing a ring hose that could be expanded by the pressure of water. This hose was made in the form of an endless rectangular ring of the length and breadth of the gunwale of the caisson. When dilated it was about 9 inches in diameter, and it was secured in a flatted condition in a shallow groove formed in the upper side of the gunwale of the caisson. The ring hose was fitted with four small branches, which extended at first downward into the gunwale of the caisson, and then outward through its sides, so that the branches could be connected with hose passing up through the water and connecting with pumps for forcing water into the ring hose. Two of these branches were at the forward end of the caisson, and two at its stern; one of each pair of branches being for the supply of water, and the other for its escape at a determined height above water, according to the desired pressure to be exerted in the ring hose. One only of each pair of branch hose was actually used, but two pairs were provided by the American engineers as a provision against the accidental injury of a single pair.

Means had to be provided for access to the caisson, and for introducing into it the plates to be riveted over the fracture. For this purpose rectangular openings or ports were made in what would be the outer side of the caisson when in place under the ship. Curved trunks or passage ways were fitted to these ports, and extended laterally from the caisson. They were about 35 feet in length, and when the caisson was in place their upper ends extended about six feet above the surface of the water at the side of the ship. One of these passage ways was near the forward end of the caisson, and the other was near its stern, each being six feet by four feet transversely, and each being fitted at its convex side with a ladder.

In order to pump out the caisson and the great mass of water which filled the cellular space between the two skins of the ship, an Andrews' centrifugal pump was employed, of a minimum capacity of 3,000 gallons per minute, and this pump had necessarily to be located close to the caisson, so as to receive the last water therefrom. The pump was therefore secured to a frame bolted to the outer side of the caisson, and it was operated by a pair of Andrews' oscillating engines, which were secured to a frame at one of the coaling ports of the ship. The connection between the engine shaft and the pump shaft was a cast-steel shaft, whose lower end connected with the pump shaft, and whose upper end was fitted with a pulley, to which the belt from the pulley on the engine shaft was applied. When the caisson was in place the pump was partly under the ship, hence the connecting shaft was made in sections connected by universal joints, so that it could curve to suit the form of the ship. The pump engine was supplied with steam from two portable boilers located on the upper deck of the ship.

When the caisson and its appurtenances were ready, they were taken to the ship, which meanwhile had been moved to the vicinity of Throg's Neck, where there was a greater depth of water. The weight of the caisson and its displacement when filled with water were carefully calculated, and sufficient ballast by weight was put into it to cause it to just sink in water, the larger part of this ballast being chain cable, so that it could be readily pulled out. The caisson was filled with water, was lowered in the water to a measured distance, which had been previously calculated, and was drawn laterally under the ship to as nearly as possible the position of the fracture. Then the chain cable ballast was withdrawn from the caisson, so as to cause it to float upward against the ship, and at the same time it was hauled bodily sidewise by cables taken from it to the farther side of the ship, the extent of movement being determined by measured ropes, so as to place the caisson in the predetermined position over the fracture. The operation of placing the caisson in position, with the "Great Eastern" swinging in the tide way of the East River near Throg's Neck, can readily be imagined by an engineer, when the size of the caisson is considered, and its two lateral passage ways, and also the difficulty of handling such a body and bringing it to its exact position by means operated above water, while the gunwale of the caisson was out of sight 27 feet below water, and beneath the ship.

When the caisson was got into place cables were passed around it and the ship, and were hauled taut by means of the ship's capstan and heavy tackle. Then wedges were driven between the chain cables and the ship so as to cramp the caisson as firmly as possible to the outside of the hull. A diver was sent into the caisson to examine the seam between it and the ship, and he reported that while the seam was not more than four inches wide at any point, the cross beams between the gunwales of the caisson bore on irregularities of the fractured plates. Provision had been made for such a contingency by constructing the upper edges of these cross beams of wooden blocks which could be readily split out by a diver. When this was done the gunwale of the caisson was as close to the hull of the ship as it could be got before pumping out the water. Hence the ring packing hose was dilated with water under pressure so as to close the seam, and pumping was commenced.

The pump was run at a rate to discharge about 4,000 gallons of water per minute for the whole of the first day without lowering the water in the upright passage ways more than 18 inches. A diver sent into the caisson after the pump had been running for several hours reported that he could not detect any current through the seam between the caisson and the ship, but that there was a strong current from the ship through the fracture into the caisson. Such a condition was expected until the cellular space between the two skins of the hull was emptied of water; but when the pump had been operated much longer than would have been sufficient to discharge such water the engineer in charge was forced to the conclusion that the diver, who examined the bottom of the ship under the direction of the officers of the ship, had been mistaken as to there being but one fracture, and that there were probably others by which water entered the space between the two skins as fast as it could be pumped out of the caisson. Hence a re-examination of the bottom of the ship became necessary, and this was conducted under the direction of the engineer in charge in so thorough a manner that every part of the ship's bottom could be felt by the divers. This examination developed the existence of several other fractures mostly small, and of one, between the caisson and the keel of the ship, which was twenty-four feet long and about three inches in breadth for the larger portion of its length, so that it would admit many times the quantity of water that the pump could discharge. The small fractures were closed by cramming fibrous material into them, and the large fracture was stopped temporarily by means of an apron of rubber belting applied to it while the pump was in operation, so that the pressure of the water would force the apron against the bottom of the ship.

The stoppage of these smaller fractures enabled the caisson and cells of the ship to be pumped out, but on the same evening that this was accomplished there was a heavy storm during which the ship dragged both anchors even with the paddle wheels in operation. In the darkness and during the height of this storm some malicious member of the ship's crew cut a large hawser by which the forward end of the caisson had been secured to the after main paddle beam of the port paddle box. The cut hawser drifted against the pump shaft, which being in motion wound it up, and the lateral strain caused the shaft to snap in two, thus paralyzing all operations and permitting the caisson to fill from the leakage through the twenty-four-foot fracture. The ship s pumps were immediately got at work upon the cellular space at that side of the ship, and by their means the water was kept within about four feet of the surface outside of the caisson, so that the external pressure upon it was about two pounds per square inch of surface. The caisson also had been so securely cramped to the ship that it did not shift longitudinally.

The malicious destruction of the pump shaft showed that a plan must be devised for operating the pump that could not be tampered with. For this purpose a wooden trunk was constructed about five feet square and thirty-five feet long. One end was closed and the pump was secured in this end with its suction nozzle at one side of the trunk and its discharge nozzle at an adjacent side, the shaft of the pump being horizontal. A sufficient quantity of chain cable was faked over the pump to sink the trunk endwise as low in the water as the caisson. The engine was mounted upon two timbers extended transversely across the upper open end of the trunk, and a connection of the pump shaft with the engine was made by means of a belt extended from the belt pulley of the engine shaft downward through the trunk to a belt pulley on the pump shaft. When the trunk was lowered to its position its upper end was bolted to the side of the ship and the chain cable was drawn out of it. The suction nozzle of the pump was connected with the old suction pipe protruding from the caisson by means of an india rubber suction hose and a sufficient length of the same kind of hose was applied to the discharge nozzle of the pump to deliver the pumped water above the surface. A shed roof also was built over the engine to prevent the dropping of any article into the trunk. With this arrangement of the large centrifugal pump there was no further trouble. The caisson was pumped out and preparations were immediately made for riveting iron plates over the fracture.

The pumping out of the caisson enabled the residue of the water between the two skins of the ship to be pumped out by the ordinary pumps of the ship, so that access could be had to the interior of the cell in which the twenty-four-foot fracture had been made. This cell was then isolated from the others by fitting plates to the manholes which connected the cells, so that the leakage could not enter the residue of the space between the skins nor flow into the caisson.

A careful examination of the caisson demonstrated that its gunwale had been so accurately shaped to the form of the ship's hull, and that the caisson had been so carefully placed in the predetermined position, that a knife blade could not be inserted at any place between the inside of the gunwale and the ship's hull. The packing of the joint was secured by the hose dilated by water under pressure, and the leakage was reduced to an insignificant quantity by means of sea grass which was taken down by a diver and distributed along the outside of the seam, so that it was forced into any crevice between the outer side of the gunwale and the hull by the pressure of the water tending to enter the caisson. In fact the leakage was so slight that a small pump only was used to keep the caisson dry while the repairs were made.

The fitting and riveting of plates over the fracture was effected in the caisson about as readily as if the ship had been in a dry dock. The caisson was well lighted and rivet holes were drilled in the ship's hull by the engineering crew of the ship. The plates were passed down the passage ways into the caisson, and the riveting was done by two gangs of riveters furnished by a machine shop in the city. The patch required to restore the form of the hull was about 94 feet long and in one place about 10 feet broad, diminishing in width towards its ends. The whole work was done so thoroughly that when it was inspected before the removal of the caisson by the officers and experts of the principal marine insurance companies of New York, freight for the return voyage to Liverpool was insured at the ordinary rates.

Remarks to No. 2 of Cincinnati, N. A. S. E.

We give below the remarks referred to on page 8 of this issue:

To the Officers and Members of Cincinnati Association, No. 2, N. A. S. E.:

BROTHERS—In preparing and making arrangements for the carrying out of the programme of instruction for the remaining months of the year 1893, the only object aimed at, and the end sought, is the advancement of every member of our Association in mechanical engineering, and not only to assist every one in keeping fully "abreast with the times," but to prepare for wider fields of usefulness in the future, as the evolution of the steam plant goes on year after year, believing (I think it was Daniel Webster who said) that "there is always room at the top."

The carrrying out of a programme of instruction cannot be said to be the work of one member only, but rather the work of the whole Association; therefore, to get all out of the lectures and discussions that is in them, it is wise to come to the Association hall prepared, having studied or thoroughly read the subject, never hesitating to

ask questions or for further explanation, when the words or ideas of the speaker are not understood.

The programme, it will be observed, is one embracing subjects of unusual interest to practical engineers. In arranging the subjects, the object sought to accomplish was to harmonize the theory and practice of steam engineering. There are still chasms to be bridged, lying between theory and practice—between technical education and practical engineering.

This Columbian year (coupled with what we expect to see and learn at the World's Fair) seems laden with grand possibilities, and a still greater future is within our very grasp.

It is hoped that some of the subjects on our list may assist us to avoid one-sided development, and enable us to take broader and more correct views of the great problems of the day, which affect every department of life. As it is universally acknowledged to-day that the steam engine is the most potent factor in advancing modern civilization, it is hoped that the programme may contain something serviceable to every member of our Association.

I remain, brothers, sincerely yours,

WILLIAM WADDELL,
Instructor.

Columbian Exhibition Notes.

Editorial Correspondence.

Any one who has had much opportunity to see how new machine shops are started, knows that because the new boilers are ready to be fired and the new engine to be started, it by no means follows that the shop is ready for business, to do good work and earn money. Usually after the engine is started there is much work to do in the way of placing the new machines, putting up countershafts, arranging belts, stopping to doctor bearings that "run a little hot," etc.

That is about the condition of the World's Fair. Here and there an exhibit is actually ready for inspection, but these are the exceptional cases, and over a very large proportion of the floor area, chaos reigns supreme, and the three electric traveling cranes that were during the exhibition to carry passengers from one end to the other of the magnificent Machinery Hall, are really engaged in carrying packing boxes and parts of machinery over the heads of the few visitors that are trying in the face of extraordinary difficulties to see the machinery exhibit.

Though many of the American exhibitors are far enough behind, the foreign exhibitors in the Machinery Hall are much more behind, generally speaking, and Chief Robinson especially complains of their tardiness, attributing it mainly to the fact that those who control the matter seem to prefer to divert the force of men employed in installing the foreign exhibits to the manufactures department to the detriment of the machinery exhibit. This state of incompleteness is, however, really one of the most noticeable features of every part of the exhibition, though it should be said that enough is completed to show that if it is not to be the greatest and best exhibition in every department that the world has ever seen, it will be the greatest in most respects, and will be well worth the time and expense involved in visiting it to every one who can afford it and has an interest in man's work and the progress of the world.

Figures giving in feet, yards and acres the size of the buildings and grounds have already been given in these columns, and there is no need to repeat them. Suffice it to say that very few who read these figures can form any conception of the grand scale upon which everything has been projected and carried out here. The only way to do this is to completely exhaust one's self, as I have done, in the effort of walking about the grounds and buildings, to make, as it were, a reconnaissance to gain some general idea of the progress that has been made, and of the probable time that will be required to fully complete the work of installment. After three days of such tramping, in which I have naturally paid most attention to the machinery, I think I can say that I am beginning to have some comprehension of the magnitude of the affair, and though it seems as if the work yet to be done before the show is finished will require two more months of preparation, it is to be remembered that an army of men are at work doing it, and the transformation that has taken place within the year since the members of the A. S. M. E. on their way to California visited the grounds, shows what wonders can be accomplished by a large body of men aided by all the latest appliances for the execution of work.

That the location chosen for the Fair is nearly an ideal one there can be little doubt. It has a frontage of two miles upon the shore of Lake Michigan, and is so arranged that the waters of this inland sea are used to fill up a large portion of the space between the buildings, thus adding much to the beauty and attractiveness of the grounds, as well as affording a ready means of going about from one part of them to another by means of the rapid and convenient electrically driven launches, of which there are a great number always moving about, and which have regular landing places at or near every principal building. These are driven by screw propellers, the motor being about amidships, and the storage batteries fore and aft. They take a passenger completely around the lagoons (practically the complete circuit of the grounds inside the line of the buildings), a distance said to be something over four miles, for 50 cents, and there is a lesser charge for a shorter distance. There are also gondolas, which are slower and have no regular landing places, these being patronized by those who are in no hurry, or are attracted by the gaudy trappings of the boats or their gondoliers. A third means of getting about is found in the intramural railway, which runs its trains on an elevated structure, and makes almost a complete circuit of the grounds outside the line of buildings, the fare on this being 10 cents to or from any point. The motor here is also electric, power being derived from an Allis engine located in the Forestry building.

The fact is that this is much more an exhibition of the machinists' art than is indicated by a visit to Machinery Hall. Most of those who will visit the exhibition will no doubt judge of the importance of the machinist and his work by what is to be seen in his own department, and they will be apt, unless they are unusually discriminating, to rate him too low, for Machinery Hall is undoubtedly less attractive simply as a spectacular exhibition than any other leading feature of the Fair, and I am inclined to think that it is less completely representative than is any other department of the exhibition. There is in this, as in other exhibitions of machinery, very little attempt to attract attention by display features. It is simply machinery—for the most just such machinery as can be seen in good machine shops or machinery ware rooms, only there is more of it than has ever been gathered together in one place before. He who has opportunities, and who makes it his business to keep posted on what is being done in the way of new developments in the machine line, will not find much that is new to him here, but those who have this opportunity are by no means the majority. So far, there is little foreign machinery to be seen, but there will probably be much more in view before long, much of the space assigned in the foreign sections being as yet entirely unoccupied. Enough of the work of installation has been completed, however, to show that the assignment of space in the foreign sections has been on a much more liberal scale than in the home sections, this being due probably to the difficulty of scrutinizing applications so closely, and also to a very proper desire not to give any opportunity for a charge of illiberal or unfair treatment of those who, in a sense, are our guests.

This commendable reluctance to interfere in the assignment of space to exhibitors in the foreign sections has, however, led to some rather strange features; as for instance, the visitor who enters by the main entrance to the building will find among the first things to obtrude itself upon his vision an exhibition of a hygienic bed-room closet, the most prominent feature of this exhibit being nothing more or less than numerous specimens and forms of that very humble though useful utensil, the trade name of which I do not know, but which is seldom seen outside of bed-chambers, and which has about as little to do with a machinery exhibit as anything that can well be imagined. It is in the Austrian section and there seems to be no way of avoiding this very ludicrous feature in this very prominent position, though it very evidently belongs in the department of Manufactures, which is necessarily less specialized than that of machinery.

Another feature which seems somewhat strange in view of the talk of lack of space, is the exhibit of a firm of fountain pen manufacturers who belong in Chicago and have a considerable space in the American section of Machinery Hall which they are using mainly for show cases that are filled with fountain pens. They have some polishing wheels in place which they say they are to use as soon as they obtain power, in showing the methods of manufacture followed by them; but there will be little in the exhibit so far as any one can judge to entitle it to be classed as a machinery exhibit, and it would seem to be better for all, including the exhibitor himself, if he were in the Manufactures Department where he evidently belongs.

On the other hand one of the most interesting exhibits to be found upon the grounds—that of the American Waltham Watch Company—which shows a number of its most interesting automatic machines in operation is in the Department of Manufactures, where it perhaps belongs, but no machinist can help feeling that it is a machinery exhibit and should be credited to the machinists no matter where it is located. Then, too, the full-sized wooden model of John Fritz's 150-ton hammer is set up in the Transportation building, though it certainly belongs to the department of Machinery and is an exhibit—not of a machine it is true, but of a very satisfactory representation of the real thing—the largest hammer in the world, a machine tool pure and simple, that has no more to do with the Transportation Department than with a number of others. The Transportation Department is largely an exhibit of machinery, however, and some of the machines to be seen here are very interesting too, both from a mechanical and from a historical point of view, of which we shall have more to say in future.

Any one who takes the trouble to talk to exhibitors and their representatives in Machinery Hall will find that rightly or wrongly they are almost universally very much dissatisfied with the way things have been going. They claim that there has been unfairness in the matter of charges for power for running machinery. The amount charged for this is $60 per horse-power during the term of the exhibition. Those who expected to avoid this expense by taking advantage of the permission given to run machinery occasionally without charge have found upon investigation that when a possible customer or other interested person comes along for whom the exhibitor may want to show his machine in operation he must in each case go to the office of the Director and obtain permission to run the machine for that particular occasion. Of course this means simply that he must pay for power, so that he can run his machine when he wants to without having to make special arrangements for every movement of it. Then there is some kicking about the regulations pertaining to the arrangement for transmission of power to machines. A printing press manufacturer found that in order to run belts up from beneath as he should do in order to operate his machines properly he would be required to do so much and go to so much expense in order to satisfy all the powers, including the insurance companies, that he was finally compelled to give it up and arrange for overhead transmission, much to the detriment of his exhibit; the posts necessary to support the shafting obstructing the view, interfering with the accessibility of the machines and detracting much from their good appearance.

In the matter of connections to the water service within the space of exhibitors there is also very much complaint. One exhibitor had a connection made and a wash bowl put in at an expense of $86, which he thought was exorbitant; but it was no more than fairly completed before he was informed that on account of the concession which had been made to the company controlling the sanitary features of the buildings no wash bowls in exhibitors' spaces could be allowed, and it was taken out. This means that an exhibitor of machinery who may wish to show its operation and thereby gets his hands soiled must go to the end of the building and pay five cents for admission to an apartment where he can wash his hands; then he can return to his space, and if he has taken the precaution to chain his prospective customer to the railing may find him there on his return and may then proceed to write a contract or to conduct such other business as should follow an exhibition of machinery in motion, and which requires clean hands.

Insurance rates have reached 7 per cent. for the term of the Fair; or a 14 per cent. annual premium, and many of the machinery exhibitors are carrying no insurance whatever. They attribute this to a desire upon the part of the companies to beat them, but on the other hand the companies state that the reason is that there is not sufficient capital to insure the goods on exhibition here. Insurance companies are restricted in the amount of risks they can write in any given locality, and it is claimed that many of them have reached the limit here, and this has led to bidding for remaining and available insurance, and has run the rates up. This view of the case seems to be borne out by the fact that the buildings themselves are insured for about 2½ per cent., but were insured some time ago when there was less demand for insurance here. It is stated that there are about fifty million dollars worth of goods in the various buildings of the Fair and that the available insurance capital is not sufficient to cover them.

The things mentioned above are by no means all that exhibitors find to growl about, and the rule prohibiting profanity, and which gives the "tin soldiers" as the gorgeously gotten up Columbian Guards are dubbed, authority to arrest any one who breaks it, is nevertheless frequently broken, especially, one mechanic declares, by the traveling men who are in charge of many of the exhibits, and who the machinist avows are much more wicked than machinists, and swear much more recklessly at apparently needless delays which seem to them to be attributable to red tape and the operations of the circumlocution office.

This, of course, is one side only; the other side of the story is not so readily obtained, but it is significant that Chief Robinson, who had experience with the Centennial, as well as with this exhibition, freely declares that he has had enough of the business now, and would much rather be at sea in charge of the engineer's department of a naval vessel, although he intimates that he has had his share of this experience also. These difficulties, perhaps inseparable from the starting of an enterprise of such magnitude, will probably soon be forgotten and things will begin to move along more smoothly.

Though it is true that the exhibition is very far from complete, it is also true that it is well worth a visit now by those who can visit it at no other time, but it is better to defer coming for about one month, when it is probable that it will be fairly complete.

As to the expense involved, it must be said that there seems little chance of visiting the exhibition from any considerable distance without considerable outlay both in

(*Continued on page 9.*)

Variable Speed Power Transmission.

BY M. E.

The paper by Mr. H. C. Spaulding on "Variable Speed Power Transmission," read at the recent meeting of the Mechanical Engineers, seems to have attracted more than passing attention to Mr. Gordon's variable speed pulley, which is fully described in the contribution referred to. Early in the paper mention is made of speed cones and their somewhat restricted scope is alluded to. Mr. Gordon's device, however, does not appear to me to show much improvement in this respect over the cones, and the principal advantage accruing from the use of his pulley seems rather due to the possibility of running the rope or belt upon a loose pulley, and in the gradual alteration of speed, which can be effected in a more reliable manner than by the use of the well known continuous cone drums so much employed in spinning machinery.

Mr. Gordon's device, which is shown in the diagramatic sketch, Fig. 1, consists of two disks *A* and *B*, of which one may be fixed to the shaft, while the other is capable of being moved laterally by suitable means. The inner faces of the disks are tapered in section, so that the space between them is wedge-shaped as shown. It is clear that if a rope or belt is run in this adjustable wedge groove the virtual diameter of the pulley will depend upon the relative position of *A* and *B*, being greater as these are brought nearer together, and less as they are moved apart, until, when the distance apart of the nearest points exceeds the diameter of the rope, the latter will fall onto the loose pulley *C* placed to receive it. To obtain the full effect, both driving and driven pulleys require to be similarly arranged and adjusted, failing which a tightening or jockey pulley must be used to take up the slack, and to maintain the tension. It is evident that ordinary thin belting will be unsuitable as a transmitter, and that for the best results ropes or thick wedge-shaped leather belts should be employed.

In Fig. 2, let *a* represent a rope of radius *r* at the smallest diameter of the pulley, and *a'* when at the largest. Then the distance $p\ a' = r\ cosec.\ \frac{\theta}{2}$; θ denoting the whole angle included between the pulley faces. If we accept the common rule for the minimum pulley diameter, viz., 30 rope diameters, we have

$$V = 3\tfrac{1}{8}\ cosec.\ \frac{\theta}{2},$$

V representing the per cent. of increase of pulley diameter under the conditions stated. With a groove, including an angle of 30 degrees—the smallest which should be used to avoid damage to the rope by wedging—we have an increase of $V = 3\frac{1}{8} \times 3.86 = 12.83$ per cent. in the pulley diameter, giving a proportionate variation in the speed of transmission of a tightening pulley as used, or double of this if both pulleys are variable. As will be seen, the range is not great with the angle selected. Taking so acute an angle as 10 degrees, we have only $V = 3\frac{1}{8} \times 11.47 = 38.22$ per cent. of variation with one, or 76.4 per cent. with two pulleys—a range which can, of course, be easily obtained by the ordinary system of cone driving.

From these considerations it would appear that, so far as rope driving is concerned, the device does not offer a very wide range of speed variation if the angle of the groove is kept reasonably obtuse. With an angle of 10 degrees, such as is shown in the sketches of the pulley, the loss of power due to wedging in the grooves would be very great, and the wear and tear of the rope necessarily severe. Moreover, it appears to me that in forcing the rope off the loose pulley in order to make it take a bearing upon a larger diameter, the rope will be injured by crushing to some extent. In all probability, however, the rope would soon conform to the groove, and remain permanently wedge-shaped, which would greatly assist it to rise in the groove under the lateral pressure.

With regard to what has been done before in this direction, I would say that I have had some experience with a variable speed pulley shown roughly in Fig. 3, and which, as will be seen, is somewhat on the same lines as Mr. Gordon's device. This was, I believe, shown at one of the Paris exhibitions several years since, and was to my knowledge used in England at least six years ago. It will be understood to consist of two intermeshing, prong or claw pulleys *A* and *B*, each forming parts of hollow conical shells. One of these, *A*, is preferably keyed to the shaft, while the position of *B* relative to *A* may be varied in any convenient way, the method shown answering very well for small pulleys. The angle of the groove thus formed can be varied within very wide limits without affecting the possible variation of the pulley diameter, which, as will be seen, may be made very extensive if desired. By making the angle 90 degrees, ordinary square leather belting can be used with good results, while for ropes, a more obtuse angle than usually adopted may be used, as the grip is greatly augmented by the peculiar formation of the groove, which gives a slightly serpentine motion to the rope as it passes over the pulley. This action is certainly not good for the rope, but if the edges of the prongs are well rounded so as to avoid cutting, no great harm need result.

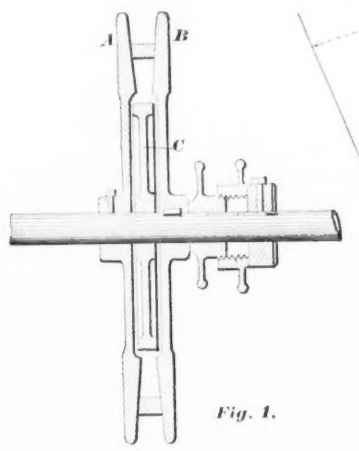


Fig. 1.

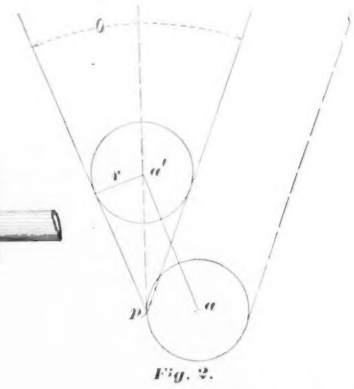


Fig. 2.

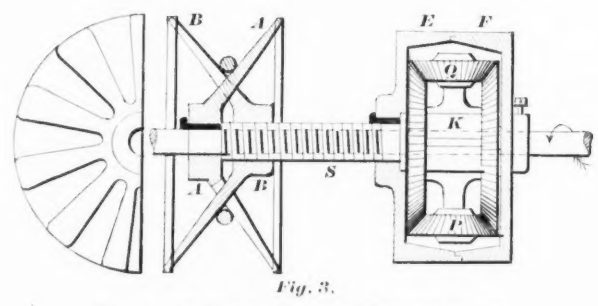


Fig. 3.

VARIABLE SPEED POWER TRANSMISSION.

With the arrangement as sketched, unless the pulleys are a fair distance apart, the driven pulley would require to be of a similar construction, and to be correspondingly varied in diameter, in order to maintain a uniform tension. When the amount of power transmitted is not great, however, a strong spiral spring is sufficient to keep the sides of the driving pulley apart, this spring yielding as the tension on the rope increases, owing to the driving pulley diameter being increased. Various methods of applying this spring, or of varying the diameter of the driving pulley whilst in motion, will doubtless suggest themselves, but as the arrangement shown in Fig. 3 for the latter purpose has been found to answer very satisfactorily, its construction may be briefly indicated.

E and *F* are two small pulleys, of which *F* is free to turn on the shaft, while *E* is secured to the threaded sleeve *S*, which carries the half pulley *B*. *E* and *F* are provided with bevel teeth, as shown, into which gear the small pinions *P* and *Q*, these latter being carried by and turning upon the cross-piece *K*, keyed to the shaft. The pulleys *E* and *F* are arranged to incase the gearing, and are turned on their peripheries to receive two brake straps. By applying the brake to *E*, the screw *S* is held, and *B*, by turning upon it, is brought farther from the fixed half pulley *A*, thereby increasing the pulley diameter. If, on the other hand, *F* is held, the pinions *P* and *Q* are carried round by *K*, and impart to *E* a motion in the direction of rotation, but *twice as rapid*, so that the threaded sleeve screws *B* towards *A*, and reduces the pulley diameter.

It may be added that for the sake of safety to workmen the prongs of the half pulleys should be hooped. Finally, I would say that the arrangement is not suitable for transmitting very large powers, nor for very large pulleys. Under certain circumstances, however, the device may be found of service, and it is therefore given for what it is worth.

Improved Circular Re-saw.

The machine which we illustrate herewith is one of strong and compact construction, calculated for accurate work in re sawing. It will split either hard or soft wood and saw straight or bevel, especially adapting it for use in saw and planing mills, furniture factories, etc.

The iron frame is of extra heavy weight, and has broad foot-plates, so that it will stand firmly and solidly on the floor.

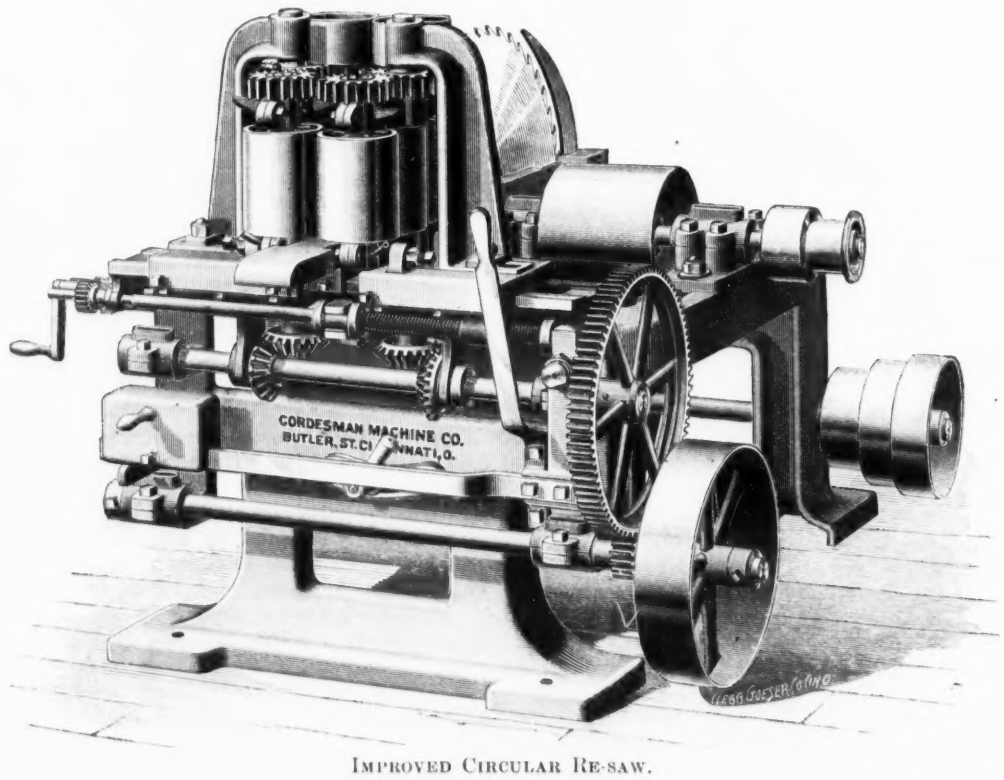
The feed-works consist of four 5¼" diameter rolls, strongly geared and held to the work by a heavy weight. This feed is driven from the saw mandrel by means of an intermediate countershaft, an arrangement which permits the tilting of the feed-roll works, without interfering with the tension of the belts. The feed is easily stopped and started. Two rates of speed are provided, and changes from one to the other are made by merely shifting a belt.

The rolls can be adjusted singly or together by means of a crank-handle at the end. The rolls are also made self centering, which, for instance, would permit an inch board to follow another 1¼" thick without making a separate adjustment of the rolls, and sawing both boards exactly in the center; or, as desired, either set of rolls can be made stationary while the other yields, by simply loosening a nut, which enables the operator to cut a quarter or half inch slab off a board of any thickness. Another feature is that the rolls are made to work close to the board rest, so that a half inch strip can be cut, if necessary.

The housings supporting the rolls are gibbed to a heavy swing frame, which is fitted in a semi-circular bearing, and can be tilted by simply loosening a nut, placing the machine in readiness for bevel sawing, such as clap-boards, siding, etc.

The mandrel is heavy, and driven by a pulley of large diameter and face. The self-oiling bearings of the saw mandrel are fitted into grooved ways on the frame, to adjust forward as required, allowing for all wear on the saw, and keeping the saw close to the rolls.

This machine is made in three sizes, to carry a 24", 30" and 34" saw. The manufacturers are Cordesman Machine Co., Butler and Front streets, Cincinnati, Ohio.



IMPROVED CIRCULAR RE-SAW.

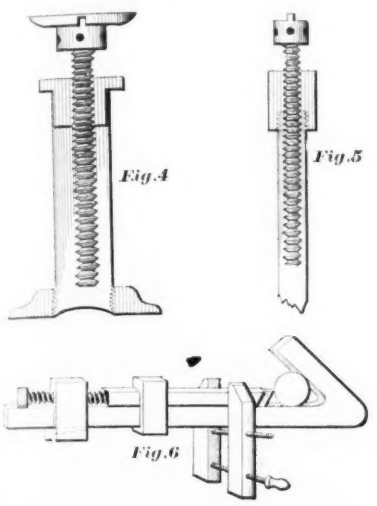
Handy Tools and Appliances—II.

BY PETER H BULLOCK.

AN ADJUSTABLE JACK SCREW.

This idea (Fig. 4, page 5) may seem peculiar, but I can assure my engineer friends that there are few appliances about the place as handy as this one. It is composed of the screw, the cap and nut, and as many pieces of pipe of different lengths as you may choose. To show how inexpensive they are, and to what extent the scrap heap may be drawn upon in their construction, I will describe of what one of my own is made. The screw is of steel 21" long, 2¼" diameter, and was formerly a part of a powerful press. The cap is a common 5" cast iron washer, and the nut one half of a set of flange shaft couplings, the inside threaded for the screw, and the outside turned down to fit the inside of 4" wrought-iron pipe. For common use I have a piece 20" long, with a flange at the bottom end. In this shape it will do all that any jack will do, and there is no reasonable limit to its extension, for it works just as well on a full length of pipe as on the shortest section. The flange at the bottom is not necessary if the end of the pipe is firmly seated on a plank or block of wood. When under strain a jack of this kind will become as substantial as a column, and as it takes up little room, the space usually occupied by blocking is left clear for any work that may be necessary to be done. Not long since I used one on the end of 17 feet of pipe as a temporary support in a building while a pier was being

built. There are many ways this same idea can be carried out I have one arranged as in Fig. 5, for 2″ pipe, the screw being of 1¼″ steel 24″ long. The nut is a plain cast-iron cylinder 3x3. Two inches of it are threaded for the screw, and 1″ is counterbored and threaded for 2″ pipe. As in the case of the larger one, a piece with flange, and about 2 feet long, is kept attached for light work when it is not wanted for some special purpose, as it very frequently is. There is a Y-shaped fork, the shank of which fits the pipe, and which is used under



shafting while leveling up or during repairs. When used under shafting or overhead work, it is best to put the screw at the bottom, and the pipe and fork at the top. I have put a spare hanger box in the fork, and supported a section of running shaft while the regular hanger was removed and repaired. This tool is also very convenient when it is desirable to give the object being raised a lateral motion, such as pushing some bed piece over a foundation, so as to make the holes come fair, for it can be set at any angle from upright to horizontal, and it will push straight away in any desired direction.

While on the subject of jack screws I must refer to the little ones that I hope every engineer has for use around the plant. They are very handy for taking up the slack of some part about the engines or pumps, such, for instance, as holding up a crosshead while removing the gibs or some other similar job. These can be made by using common commercial set-screws, and tapping out pipe plugs screwed into couplings, or through caps on short pieces of pipe. Ten of these, from ⅜x1 to 1x4, make a nice set for engine room use.

A TOOL FOR CUTTING OFF SHAFTING IN POSITION.

It is often necessary to cut off a shaft, and a great convenience if it can be neatly done without removing it from position. A tool that will do this is shown in Fig. 6. It is made of flat machine steel 2x⅜, and 4 feet long, with one end bent back into a V shape. There is an elongated collar or nut that loosely fits the bar, and which is held in any desired position by a wedge. This sliding collar or nut carries the screw that is used to feed the cutter, which is a common lathe cutting-off tool the same thickness as the bar. There is a flat iron link to hold the back end of the tool in place, but for the front end I have found that wooden clamps or a common hand-screw is the best, as you can give it any desired pressure to resist chattering, and to keep the tool from jumping into the work, as it might do if not held good and solid. The free end of the bar can be supported from above if necessary, but a stud from floor to ceiling is best, using a cleat and hand-screw to support and steady it. Of course the engine will have to be run slow to get the proper speed, and the cutting point of the tool will have to be raised and given clearance according to the size of the shaft being cut. It is surprising how effective this tool is, and how quickly a shaft may be cut off with it when properly used. After a fire, it was found desirable to cut a main shaft at a point between where power for a department was delivered and a coupling that had been sprung and broken by a falling wall The size was 3″, and it required but half an hour to rig up, cut the shaft and get to running. In one case of this kind enough is saved in time and trouble to repay the cost of this simple tool many times over.

Molding by Machinery, Foundry Appliances, Etc.—III.

By S. BOLLAND.

Mr. Harris Tabor, in a paper read before the American Society of Mechanical Engineers at the San Francisco meeting May, 1892, says: "Of all the mechanical arts that of molding has been the most difficult to formulate and reduce to a system Since the origin of metal founding the molder has been pleased to shroud his methods in certain mysteries which to him, at least, seem essential to perfect castings There is much beyond the control of the molder, in the art of metal founding, which tends to make bad castings. His strongest influence upon the quality of his work lies in the skill which cannot be verified by caliper, gauge or rule. The molder's art is in making the mold of its proper density. Drawing a pattern from the sand after it has been rammed and mending a broken mold are mechanical operations easily taught—it is not so with ramming. If a touch of genius enters into the molding it is shown in making the mold of such density that it will stand pouring without 'straining,' and be soft enough to prevent 'blowing' and 'scabbing,' with a certainty that the sand will remain in place until the iron has solidified. This is the molder's skill which cannot be formulated and passed down to succeeding generations in books." It is very evident, from the above, that Mr. Tabor knew what difficulties he had to contend with when he undertook to make a molding machine that would, automatically, overcome them all; what course he pursued may be partially gathered from what he says in another part of the paper quoted; "In the spring of 1890, Mr. A. B. Moore, who was then a Stevens Institute senior, selected the rammer machine as the subject of his thesis. We discussed the lack of data bearing upon the friction of sand, and decided jointly to make experiments. An ordinary platform scale was used for weighing. A series of boxes 4x4 inches, 5x5 inches, and 6x6 inches was decided on; these boxes were supported by frames spanning the scale and resting on the ground, as seen at Fig. 12; each box was fitted with a loose bottom which rested on the scale platform. The plunger used for ramming fitted its box loosely enough to avoid serious friction, and was connected to the weighted lever by a turned joint; the weight of the lever on the sand was found by weighing it in position. In all cases the scale was weighted to a pressure equal to 10 pounds per square inch on the under face of the box. (This is about the density of the average mold surface.) We began with the 4-inch square box as follows: 2½ inches of loose sand was put in and compressed to 1 1/16 inches to give a density equal to 10 pounds on the under side, and it required a pressure of 12½ pounds on the top of the sand to produce this result. With 5 inches of loose sand, 17½ pounds pressure was required on top to give 10 pounds below; an addition of 2½ inches in the depth of sand brought the ramming pressure up to 34 pounds, and the last 2½ inches—making 10 inches—required a pressure of 42 pounds to give 10 pounds on the scales. With the 6-inch box only 11¼ pounds were needed to give 10 pounds below with 2½ inches of sand; with 10 inches, 26 pounds raised the scale beam, or 16 pounds less than was required under precisely the same conditions with the 4-inch box. The walls of the boxes were of undressed plank to represent the average condition of wooden flasks."

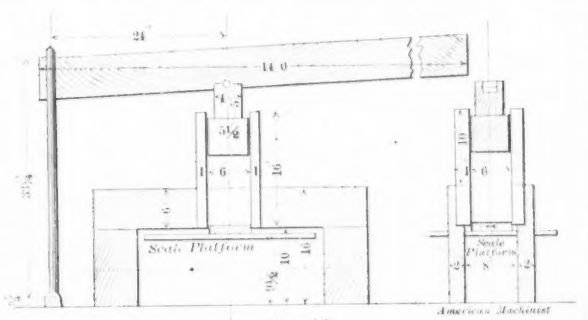


Fig. 12

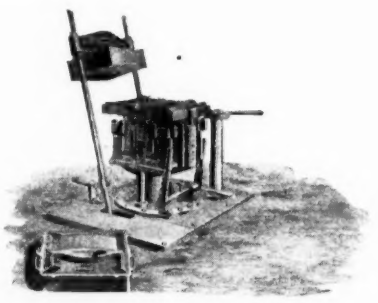


Fig. 14.

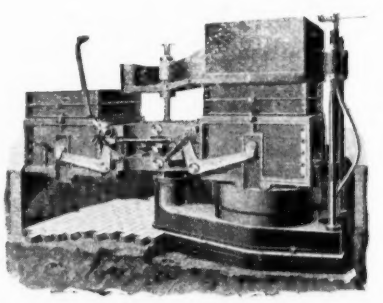


Fig. 15.

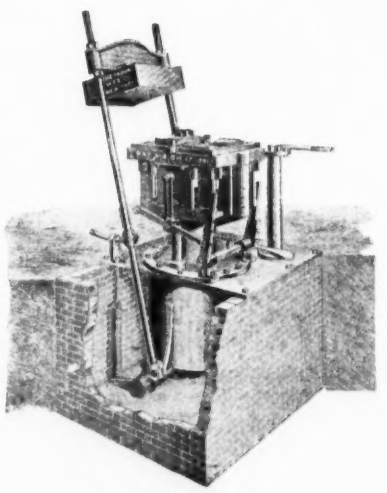


Fig. 13.

MOLDING BY MACHINERY.

THE TABOR MOLDING MACHINE

With the rammer system of this machine greater pressure may be given over portions of the mold which would otherwise be too soft. When flasks are of such a size that bars are necessary, the rammers are arranged to straddle them, thus doing away with all tendency of the bars to spring; this method also avoids the necessity of tucking under the bars. When the flat platen is used for ramming sand may be scooped away from the highest portions of the pattern until the best results are obtained. With these automatic machines the rigid platen is used for ramming, made of hard wood, and cut boldly over the pattern; by this method it is claimed that no skill or judgment is necessary in putting sand into the flask and the density of the mold, over the iron, may be made to suit any condition. The method of using flask bars for ramming is to have them detached from the flask, and short enough to be forced down without coming in contact with its walls; the flask and sand box are filled with sand, and the bars forced down by a flat platen; the bars are deeper where the greatest ramming is required and being made wedge shaped, each bar spreads the sand until it meets the spreading influence of its neighbor. The heavy flasks are placed on trucks which are topped with stripping plates and contain mechanism for drawing the patterns, the trucks are run under the machine for ramming and withdrawn to take off the mold and replace the flask. For the lighter flasks which can be lifted by hand the machine shown at Figs. 13 and 14 is made; the figure shows the floor broken to give view of the machine below the floor line. The piston takes steam on the under side only, its weight being sufficient to return it promptly after the mold is rammed. To the piston rod is attached the principal part of the mechanism, consisting of a table with lugs projecting upwards and supporting the pattern frame upon which rest the patterns. The stripping plate frame is directly over the pattern frame and rests on it, to which the stripping plate is attached. The stool plate is suspended to the stripping plate frame and moves with it, the side levers and tumbling shaft are for tripping after the pattern is withdrawn. The pattern frame has an annular passage which connects with the cylinder and admits some steam to the pattern plate at each movement, thus keeping the patterns in a dry condition for smooth working. The stool plate is really part of the stripping plate frame placed below the pattern frame, its object being to support stools, or internal parts of the stripping plate used in holding up the green sand cores, or heavy bodies of hanging sand while the pattern is being drawn; these stops can readily be changed to suit any pattern within the range of the machine. The ramming head is carried by the wrought rods seen at either side of the machine. The steam pipe enters the cylinder at the bottom, and from the throttle valve to the cylinder serves also as an exhaust pipe, the throttle valve being a two-way cock by which steam is both admitted or exhausted from the cylinder. The half flask is put on the stripping plate, with the sand box to hold the sand which is to be compressed, and both are filled with sand; the ramming head is then swung forward over the flask against the stops which define its position, and the throttle valve opened; the upward motion of the piston and attached parts carries the flask and sand up to the ramming head, where it is rammed instantly, and upon the lever being moved again steam is cut off, and at the same time exhausted, allowing the flask to descend; the stops then engaging the free ends of side levers and arresting the downward motion of stripping plate at a point about midway; the pattern continuing to descend is drawn from the mold, and when the piston has returned to its lowest position the sand is struck off the flask which is then taken from the machine. As the man removes it he presses the tripping treadle with his foot to release the stripping plate frame which then falls to its proper position with respect to the pattern and the machine is ready for another mold. Water or compressed air may be used instead of steam, if it is desirable, though it is believed that steam is preferable in most cases, because it is usually easily obtained without the use of special auxiliary machinery of any kind.

THE YIELDING PLATEN MOLDING MACHINE.

The Atlas Engine Works, of Indianapolis, Ind., are the makers of the above named machine, a perspective view of which is given at Fig. 15. The top of this machine is provided with a rubber bag filled with water or compressed air, and the bottom or cylinder is caused to raise by the admission of compressed air, thus forcing the flask containing the sand against the rubber bag which, they claim, presses the sand in a manner that cannot be effected by any other known method. The makers say that amongst their several devices developed for yielding platen molding machines the flexible diaphragm backed by the fluid forms a wonderfully simple and effective machine. The platen yields according to the form of the pattern, thus producing uniform density of sand and perfect castings. The double rotary feature adds fully 50 per cent. to the productive capacity of their original single machine. Provision is made for reasonable variance in depth of the cope and drag without adjustment of the machine. Both drag and cope patterns are on the machine at the same time. They are made alter-

nately and the molds finished, covered and clamped on the floor ready for pouring without increasing the labor force more than one man over that employed on the single machine. The machine is turned on its center with little effort, and, in spite of its rapid work, is not wearing on the operatives. There is nothing to get out of order, nothing to break by strain. Wooden patterns can be used and drawn by hand, though drawing *iron* patterns through stripping plates is recommended. The writer has stood and watched these machines in operation and can bear testimony to the regularity as well as efficacy of their movements which is in every respect equal to what is claimed for them, quality as well as quantity being alike phenomenal.

LETTERS FROM PRACTICAL MEN.

Cutting Screws.

Editor American Machinist:

Judging from my own experience in cutting long screws of different shaped threads, and knowing the time it took me at the start, and the time it takes me now, I think I can give a few useful hints on that kind of screw cutting.

The first thing necessary is a good follower rest. If you happen to have one of these follower rests with two loose jaws like steady rest jaws, the best thing to do with it is to throw it into the scrap pile and replace it with a solid rest with a hole bored through it when in its position in the lathe, and reamed to a size large enough to admit of a bushing, large and heavy enough for the largest screw that you are liable to have to cut.

If your largest screw is 2″ diameter the follower should be bored not less than 2¼″ diameter. The bushing should be of cast-iron, and the best way to make it is to take a piece somewhat longer than necessary and place in the chuck, and finish outside and inside and one end at one chucking, then turn around in chuck and cut off to proper length and finish that end; 2½″ is long enough for the bushing. At first I made them as long as 3½″ but found that 2½″ was long enough for any of them. The cast-iron bushings wear out fast but only cost a trifle to make. I tried one made of machine steel, case-hardened and ground to size. It made a fine looking bushing, and I expected to have a fine time with it, but I didn't. About the second cut I took on that lead screw the lathe stopped without warning about midway of the cut, and I couldn't get it to go either way. Well it took about an hour to get that bushing off; then I filed the burrs off the screw and out of the bushing, for though the bushing was hard it had "roughed up." Then I tried it again. Well I made out to do the same thing several times over, but at last took that bushing off and let it stay off. It is by the lathe yet among the other bushings, but it never gets used. I got all that I wanted of hardened bushings in less than one day's experience. I went back to the old worn-out cast-iron bushing and cut the screw with that. When the cast-iron bushing gets stuck (as they sometimes will when there is considerable burr raised by the tool) they can generally be got loose inside of two minutes with but little if any damage to the screw, while the hardened one will cut the screw all the way off.

I generally turn the screw .002″ or .003″ below standard so that it will be perfectly free in the bushing, or in case the thread is to be cut on cold rolled shafting the bushing should be bored .002″ or .003″ above size for the same reason. The bushings seem to work just as well after they are worn a sixty-fourth or so loose, especially if the screw is a long and heavy one.

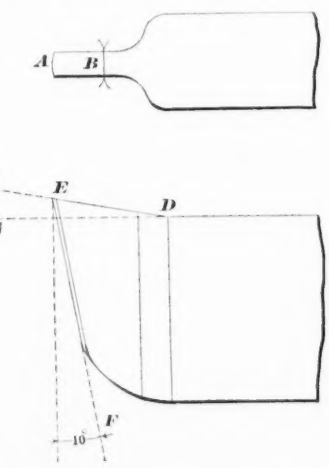
One of the most essential things for speed in cutting screws is the micrometer index on the cross-feed screw. It is not necessary to make an elaborate affair like the one described in the AMERICAN MACHINIST a short time ago. All that is necessary is a disk properly graduated and numbered, and an index pointer, fixed on some part of the carriage and brought up to the top of the disk. If the cross-feed screw is 4 threads per inch the disk should be 3½″ or 4″ diameter and about ⅛″ thick, and should have 250 graduations on it, and every tenth one should be numbered as 0, 10, 20, 30, etc. If your lathe has a hand-wheel on the cross-feed screw you can get along very well without the disk by turning a flat place on the wheel and graduating that. In this case it is best to turn the flat place at an angle of 45° from the top of the wheel and toward the lathe. I have used both styles and they are all right. After using this index for a while you will wonder how you ever got along without it.

A stop screw is of no use in comparison with it. As for myself, I have never been able to bring a tool-block up against a stop screw and have it come alike every time; but with the micrometer index it is different, it "gets there" right along.

The great advantage of the index in cutting square threads is that you can find out just how many thousandths the tool will stand and the lathe pull in good shape, and then you can take that many right along, with certainty, and no guess-work about it. It will also measure accurately the depth of thread or the tooth of a worm where there is no room to turn a place to size of bottom of thread. In plain turning or boring it is equally as useful. In fact, it is worth its weight in gold on any lathe.

I find it best in cutting square threads to use a roughing tool and a finishing tool; and the shape of the roughing tool is of considerable importance if quick work is wanted.

I make the roughing tool about .010″ narrower than the finishing tool, with 10° clearance at the end, as *E F* in the sketch, and from 7° to 10° top rake, as *C D*.



The end of the tool *A* should be slightly rounded, and this is the most important wrinkle about it, as the rounded end causes the chip to crowd together enough so that it comes out of the groove freely, while if the tool is square ended, the chip will crowd on the tool and tear out the sides of the thread with less than half the depth of cut that can safely be taken with the round tool The width of the roughing tool at *B* should be about .005″ less than the width at *A*. The finishing tool should have no top rake, but should be ground as the dotted line *G D*, and with the same end clearance as the roughing tool *E F*. The end *A* should not be more than .001″ or .002″ wider than *B*, and should be ground square across instead of being rounded.

These tools should be made short—not to exceed ⅜″ long for cutting four threads per inch (and other sizes in proportion); they will then be strong enough to take a good heavy cut. In using these tools they should be set level with the center, and the first few cuts should be light until depth enough is secured to prevent any danger of tearing out the thread at the top. The last few cuts should be light also, in order to make a smooth finish at the bottom.

The roughing tool should be run down to the full depth of the thread, so that the square end finishing tool will not have to cut more than .001″ below the last cut made by the roughing tool.

Square threads should be cut somewhat below size at bottom of thread to clear the nut, and the nut should be bored to standard size, but the thread should be cut deep enough to clear the top of the thread of the screw.

Square threads should not bear on the top and bottom of the threads. The best lubricant to use is soapsuds, or a combination of soap, oil, and water. Clear soda water is not good, as with it the tool wears very fast.

As an example of what these tools will do, I will give a little of my experience. I had twelve cross-feed screws 1⅜″ diameter and with 23½″ of double thread of ½″ lead. The finishing tools were .127″ wide. After everything was in shape, and one of the screws cut, I concluded to time the rest, and I cut the eleven screws in 20½ hours, including all the time of changing the screws and tools, and the last three screws in the lot were cut in 4½ hours.

I will say that I had the help of a Gisholt tool grinder on this job, and therefore had no tools to grind, as when part of them were dull I took them to the tool room to be ground, while the rest were getting dull.

WRIGHT.

Foundry Foreman's Organization.

Editor American Machinist:

In your paper some time ago something was said about a foundry foreman's organization. Since then I have seen nothing regarding it. If there is such an organization I would like to hear from some of its members. If not, by all means there should be, as I think it would be beneficial to foundrymen, both proprietors and foremen, to meet together annually in convention for business, and to exchange views on different subjects pertaining to foundry practice. Master Mechanics, Master Car Builders and others hold conventions annually, and no doubt derive great benefit from meeting together; then why not foundry foremen? I hope to get further information.

Charlotte, N. C. JAS. R. ANDERSON.

So-called "Rules" for Teeth of Gears —Duplex Gear Cutters.

Editor American Machinist:

Mr. Calvert's criticism of my remarks as to "rule of thumb" methods of describing teeth of gears, taking Haswell's rule as a particular illustration, does not quite fit the subject under discussion. My statement was that a handy rule, like many in common use, was impossible if we retain a decent respect for accuracy. All these rules endeavor to find a center for the circle approximating to the true tooth curve, and to locate it by some easily remembered rule that is independent of the number of teeth in the gear, while it is easily proved that the true location of that center is not thus independent. Haswell's rule is to put the center on the pitch line, and use 1.25 times the circular pitch as a radius, and, while that rule is a very good one for a certain number of teeth, about 30 or 40, and only results in a loose fit above that number, it creates an interference below it. My illustration showed the interference at its worst.

Mr. Calvert's rule, while it is very good for the particular case he selects to illustrate it, will be poor for higher numbers of teeth.

If he uses ⅛ of pitch for his given case, he must use some other fraction for another case, and, therefore, he has stepped off of the subject of discussion. The gist of a "rule of thumb" method is that it is simple and easily remembered, and it has otherwise no advantage over an odontograph. If we must consult a table to determine which fraction to use for Mr. Calvert's rule, we might as well use one of the odontographs, and get a practically correct result.

We should all be much interested in any simple rule that Mr. C. can produce, if it hits reasonably near the mark as to accuracy, and does not require the draftsman to consult a table or to cut and try until he finds a dimension or a position that is adapted to the particular case in hand. Let him prove it, not by declaring that it has given entire satisfaction, but by actually drawing several examples. A rule that will draw a pinion of twelve teeth, that will work reasonably well in all positions in another pinion of twelve teeth, and also in a rack drawn by the same rule, will be valuable and interesting, and will need no patent medicine method of defense.

If we reject all of the odontographic methods, we might as well use the well-known rule of thumb that draws the tooth with a radius of one-quarter of the pitch radius from a center on a line at an angle of seventy-five degrees with that pitch radius, for that rule is not only one of the most firmly rooted errors in the subject, but it is also very good as such rules go. If we remember the exceptions, which in this case are quite necessary to prove the rule, and doctor it to suit the case in hand, it will serve the purpose, and, no doubt, give "entire satisfaction."

I see no reason for retracting my broad statement that teeth of different numbers cannot be properly drawn by the use of a single fixed rule, or properly cut with a cutter of fixed shape.

I regret to learn from your issue of April 27 that I have cast a slur on Mr. Clough and his "duplex" gear cutter. I try hard not to offend any one when I write, but this country of ours is so large, and there are so many people in it, and so many of the people take the AMERICAN MACHINIST, that I am reasonably sure to tread on some pet corn if I write anything worth reading. I'm sure I was not thinking of Mr. Clough, and quite sure that I did not know that he had the monopoly of the invention of the duplex device. I certainly knew of that form of cutter much more than four years ago, and, if Mr. Clough's connection with it is within that limit, my information did not come from him.

This "duplex" reminds me of a trick worth two of it that was practiced for years by an old gear cutter now passed away. He took an ordinary Brown & Sharpe cutter for twelve teeth, and shoved it through everything. For small pinions or large gears, racks, internals, bevels, anything and everything that came to his hand, the old gentleman used the same cutter, and as he did no small business, there must have been many machinists who kindly "took to" the product. One day the old man was heard to remark to his apprentice, "Jim, you ain't getting that deep enough; put the cutter in a little further the *rest of the way* 'round." Some one probably "took to" that gear.

It is not a question of method, but simply of measurement, and later on I will give some figures which I do not expect will agree with those given by Mr. Clough.

There is one thing in this connection that does not appear to be known or realized by advocates of duplex or similar cutters, and that is that nothing at all is saved by their use. Any cutter must be kept sharp, and be gradually ground away until it is useless, and no more will be ground off of a set of eight cutters than off of a single duplex cutter to cut a given number of teeth. There is no economy in the use of the duplex cutter.

As to the shape of the tooth, Mr. Clough uses the qualifying statement "when properly cut and set." If properly cut and set, it would puzzle Mr. Clough to tell which tooth, the involute or the epicycloidal, would be the best, for both would be theoretically perfect as to accuracy of action. There is no point of difference between the two forms that would not apply as well to large teeth as to small ones, to teeth coarser as well as to teeth finer than six pitch. The comparison between the two forms is entirely independent of size of tooth.

As between the two methods, that by a single twelve-tooth cutter, or that by a duplex cutter, I prefer the former. As it is, I use neither, for I find it necessary to furnish the very best of everything to be sure to please my customers, and, if I should adopt any lazy make-shift to avoid the very small amount of care and intelligence required to use the ordinary set of eight cutters, I should be in hot water all the time. My customers are not of the kind that take to anything that is not mighty near right.

Further information from Mr. Clough would be interesting to gear cranks, and I have no doubt would readily find space in this paper. We want to know, for instance, what form of tooth Mr. C. uses for his cutter—involute, epicycloidal, or other. We would like to know just how he gets the figures he gives as to its accuracy, for they are astonisingly out of gear with the usual theory. We would like to know just why the epicycloidal form is more suitable for teeth coarser than six pitch, while the involute is better for finer teeth. Opinions from either Mr. Clough or myself are not in demand, and testimonials from parties who have "took to" anything are worthless, but cold facts and figures sufficient to upset the theory and practice of at least fifty years standing would be very interesting.

Lexington, Mass. GEORGE B. GRANT.

Balancing.

Editor American Machinist:

Having been many years in the business and building machines of which many run very fast, I have found out the benefit of having pulleys, cutter-heads of planers, lathe spindles, etc., well balanced.

I have found that cutter heads 24" long and 3¼" square running 4,000 revolutions per minute trembled and did more or less bad work, and the difference in weight was only as much as the weight of a five-cent piece, or about ¼ of an ounce, and this weight was only ⅝" from the center, and the spindle was in bearing 1¾" diameter. It would appear that this little weight would not make a noticeable difference on such a heavy piece, but it does.

Builders of machine tools are about the worst in balancing cone pulleys on a lathe or the face plate and pulleys on the countershaft. Even the very best shops do not balance. I have run a lathe at fast speed, having no lathe dog on it to throw it out of balance, and using only the smallest face-plate, when the cone and face-plate made the whole lathe tremble so much that I had to give up doing the work, but after taking the cone out and balancing well I could go on. Boring and turning mill tables also are not balanced. It is bad enough that the work that we put on them is out of balance, but surely the tables should not be unbalanced.

I have built machines on which the shaft 1 3/16" diameter, making about 1,000 revolutions, had a ¼" groove about 30" long, and this made the whole machine tremble, but after planing a groove on the other side it was brought in balance again and the trembling ceased.

Some of our engine builders who build fast running engines, have a wheel on the shaft and a crank-pin in it. They have this wheel balanced in the casting, partly for the crank-pin and partly for the head of connecting rod. How close they balance I do not know. Most of the engines, however, have no balance, and it is wrong to have them so.

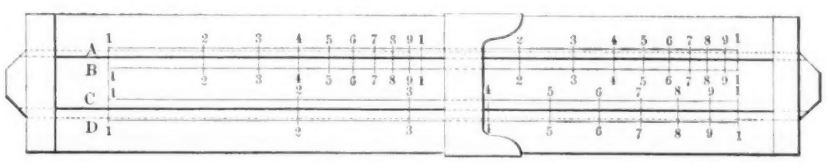
I will give another example of the benefit of balancing. Many years ago I built so-called gate saws, and built them similar to others which were built before I commenced. I used two crank wheels and pins and connecting rods on these machines, and with the balancing crank wheels made, as usual, we could not run faster than 450 revolutions on a fair floor. As it was desirable to run the machine faster I commenced to experiment with the balancing pieces in the crank wheels and soon succeeded in getting the machine so balanced that it would run 475 turns without trembling any more than before. This would indicate that balancing is of a benefit everywhere, and I claim that even a carriage will run better, at least softer, if the wheels are balanced, especially when driving fast.

I would also remark that the oiling facilities are in most cases defective.

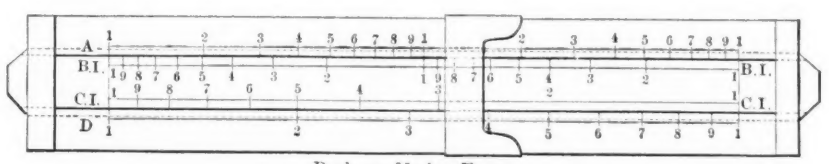
P. PRYIBIL.

THE DUPLEX SLIDE RULE.

Patented October 6th, 1891.



Front or Upper Face.



Back or Under Face.

The Duplex Slide Rule.

The advantages of the slide rule for solving accurately and with comparatively small amount of mental labor, simple as well as complicated problems frequently met with in engineering practice and other professions, will be more appreciated as its use is extended, and any improvements on the excellent rules already in use cannot fail to increase their popularity. The accompanying illustration represents the duplex slide rule invented by William Cox and recently brought out by Keuffel & Esser Co., 127 Fulton street, New York. This slide rule is similar to the ordinary Mannheim, but its distinguishing feature and improvement is that the slide itself is of the same thickness as the rule, and has consequently its two faces flush with those of the rule. Both sides of the slide are graduated; the graduations of the rule, that is, scales *A* and *D*, being alike on both faces, while the scales *B* and *C* of the slide are graduated on the upper face in the usual way, like *A* and *D*, but on the under face in reversed order, the initial indices being on the right hand, and the scales progressing towards the left. These reversed lines of graduations are equivalent to inverting the slide itself. The right and left indices of the four different scales on the reversed or under face of the rule coincide with those of the scales on the ordinary or upper face, and a metallic runner, encircling the whole rule, enables coinciding points on any scale on either face to be at once found.

With this improvement in its construction the necessity of inverting the slide, or of placing the slide in one position and subsequently in another position is avoided, and the simplicity of the operation increased; also the risk of damaging the rule during the operation decreased. Those in the habit of using the slide rule and knowing the special uses of the inverted slide, will certainly appreciate this improvement and will at once see the many advantages to be obtained from this new arrangement.

A New Hydraulic Ram.

The accompanying illustrations show a longitudinal and a transverse section of a new double-acting hydraulic ram, which is operated by water pressure derived from natural sources or from a stand pipe. It can be used in all places where the ordinary hydraulic ram can be successfully operated, and in some instances replace steam pumps. Under suitable conditions it can be successfully used for supplying summer residences, farm houses and similar places with water without the aid of steam power, and with very little expense for operating it, as practically it requires no attention.

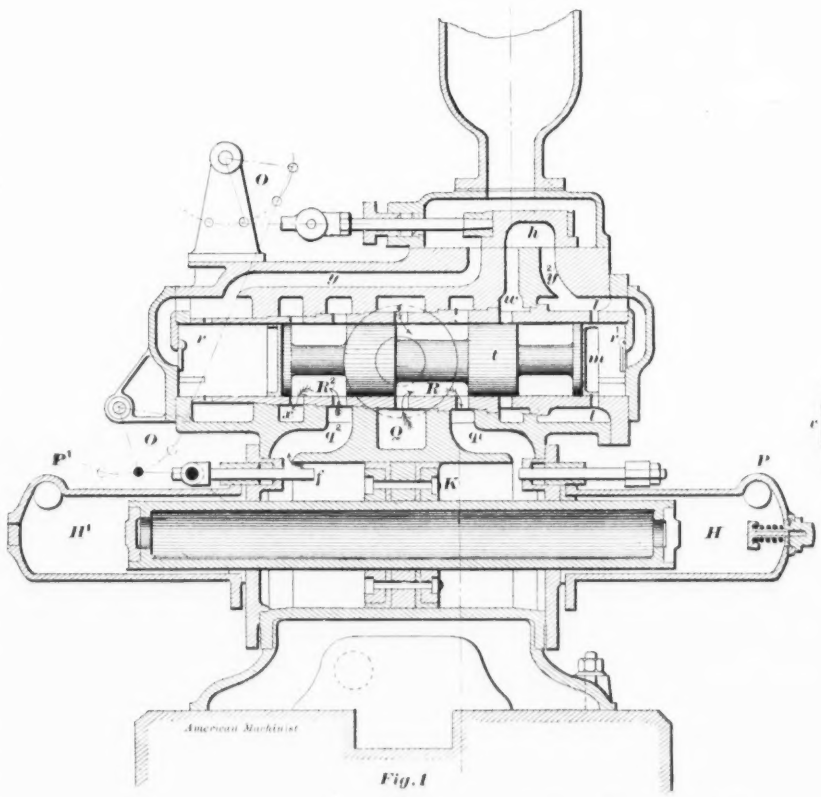


Fig. 1

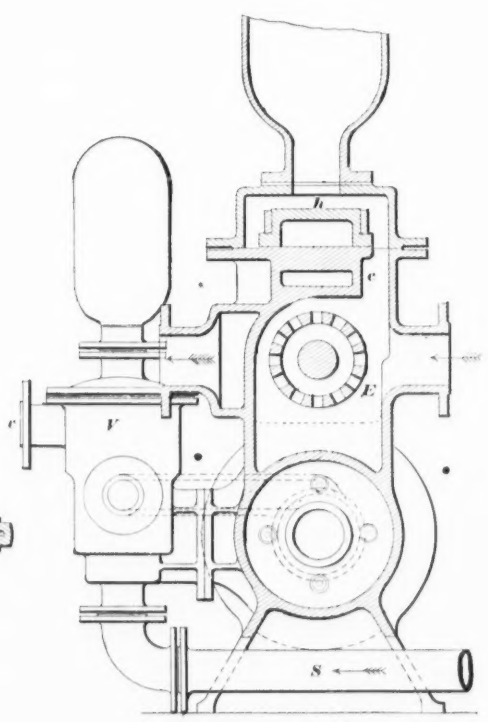


Fig. 2

A NEW HYDRAULIC RAM.

The water for operating the machine (derived from any suitable source so that the water will have the required pressure) is led to the main chamber *E* through its nozzle as shown. With the piston valve *t* in the position as shown in Fig. 1, the water will enter through the port *Q* into the annular space *R* between the two central heads of the piston valve, and from thence pass through the port q' to the right of the main piston *K*, forcing the latter to the left and forcing the charge which has been drawn into the supplemental cylinder *H'* out through the pipe *P'*; this pipe communicates with the valve chest *V*, which may be of any ordinary construction arranged to control the inlet and outlet of water through the pipe *P'*, and the pipe *P* communicating with the supplemental cylinder *H* at the opposite end of the machine. The water to be elevated or to be supplied to houses enters the valve box *V* through the pipe *S*, and from this box it enters either one of the supplemental cylinders through the pipes *P'* or *P*, as the stroke may require; of course, it will be understood that the water having entered either supplemental cylinder through the pipe *P* or *P'*, it is discharged through the same pipe when the piston reverses its motion, and then it passes through the valve box *V* again and out through the final discharge port *v*.

The water from the main chamber *E* gets to the slide-valve chest by passing around the casing of the piston valve and through the side port *c*, as shown in Fig. 2. From the slide valve chest the water will pass either to the right or left through the port y' or *y*, according to the position of the valve *h*. As shown in Fig. 1, the slide valve is at the extreme of the right-hand limit, and water has been admitted through the port *y* to the left hand end of the piston valve *t* and has forced the latter to the right, the water entering the piston valve casing through the valve *r*. During the movement of the piston valve to the right, the valve r' closes and confines the water at the right end of the casing to form a cushion; the discharge now takes place through the small port *l* only into the water passage immediately above it, from whence it enters the cavity of the slide valve and is discharged through the port *w*. The port *l* is gradually closed by the leather cup *m* on the piston valve, so as to secure an easy cushioning effect, and the movement of this valve is finally limited by the pins projecting from the heads of the chamber. When the piston valve is in the position as shown in Fig. 1, and the piston *K* is moving towards the left, the exhaust water is free to pass through the port q^2 and the annular space R^2 in the piston valve, and finally through the exhaust port *x*. As the piston *K* approaches its leftward movement, it strikes the pin *f'*, and through the transmitting mechanism *O* shifts the slide valve *h* towards the left so as to reverse the motion of the main piston.

The following is a copy given to us of the results of a test made with one of the smaller machines:

Diameter of piston, 4 inches.

Diameter of plunger, 2 inches.

Stroke, 6 inches.

Number of strokes, 50 per minute.

Head of water, 20 feet.

Vertical height of delivery, 60 feet.

Water used to operate, 1,946 gallons per hour.

Water delivered for use, 482 gallons per hour.

Supply pipe, 1¼ inch; length, 38 feet.

Delivery pipe, one inch; length, 87 feet.

A number of these machines are now in operation in Germany, and are reported as giving good satisfaction. These hydraulic rams are the invention of J. Hillenbrand, of Mannheim, Germany, and are now being introduced in this country by Leopold Joseph, 104 Chambers street, New York.

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Headquarters at the Fair.

During the continuance of the Chicago Exposition the AMERICAN MACHINIST will have its headquarters in the space allotted to the Mechanical Press in Machinery Hall. The exact location is Section No. 27, Column K 37. Word can be left with the attendant there by any one who is desirous of meeting a representative of this paper, who may at the time be engaged elsewhere on the grounds.

Not Spectacular.

In another column of this issue will be found some account of how the Columbian Exhibition appears at this time to one of the editors of this paper.

A point which may be of especial interest to machinists is in what is said regarding the relative attractiveness of the exhibit in Machinery Hall as a mere spectacle, and aside from its technical interest, which none but those versed in technical matters can appreciate. It is, perhaps, unfortunate that the machinist's work is usually of such a nature, and is done in such a way, that very few who are not themselves machinists can ever appreciate it at its true value or understand the supreme importance of machinery in the present organization of society. And it is probable that the development of the science of machine building, like the development of other arts, is carrying it still further and further beyond the comprehension of those who do not make a special study of it. It is entirely probable, for instance, that the public who know nothing of the refinements of machine design would find much more to attract them in the styles of machinery built twenty five to thirty years ago, than in the severely plain and unornamented machinery which is to day the delight of the trained machinist and engineer.

Almost the entire exhibit in Machinery Hall consists of machines which have been built solely to accomplish certain results, and everything not tending toward these results has been discarded as worse than useless. There is nothing about them to attract those who do not understand the beauty that comes from so proportioning and arranging parts, and so drawing outlines as that it shall be evident that nothing has been in view but the purpose for which the machine is constructed, and that its object has been thoroughly comprehended.

In Machinery Hall there is relatively little that is understandable to any but those who make a study of machinery. The looms which are at work weaving fabrics of fancy figures and ribbons attract far more sightseers than any other part of the show there, partly because the noise they make calls attention to them, but mainly because the work turned out by them is comprehensible in a certain degree to any one. A man walking through the Hall the other day merely glanced at one of the handsomest and most admirable steam engines ever built, from the machinist's point of view, and turned to a machine which appeared to be a veritable "mechanical cane brake"—something for a machinist to smile at, but covered with cranks, eccentrics, wheels, polished brass, nickel and glass. To his companion he exclaimed, "Now, ain't that a d—— pretty thing," and the two stood and gazed at it in open-mouthed wonder until the noise of the looms attracted their attention.

This exhibition, however, is more nearly the product of machinery than any which has preceded it. In almost every department of it, with the exception of the Art Department and some of the foreign exhibits, the supreme importance of the part machinery has played in its production is apparent to him who is familiar with modern manufacturing processes. This, however, will probably never be understood by others, and the fact that the machinery exhibit is really the least attractive one to the mere sight-seer inevitably tends to lower the machinist's importance in the estimation of others below that of departments which could not be in existence at all were it not for the machinist and his work. Though it is perhaps difficult to decide whether or not the machinist loses anything by this more than the satisfaction of that degree of appreciation which of right belongs to those who carry on the world's useful work, it is probable that it does result in actual depreciation of the value of his services and though there is probably little help for it there may be some improvement if it is fully recognized by the machinist, and proper efforts made to counteract its effects.

It is related that a party of Indians witnessed the first appearance of a locomotive within their territory in stoical silence and with no indications of wonderment or surprise; but when a telegraph lineman came along, and with his climbers easily walked up to the top of a smooth pole, the Indians went into transports of delight. The locomotive was too far beyond their comprehension for them to understand anything of its wonders, but they knew perfectly well the difficulties of climbing trees and smooth poles, and they readily understood that this man had done something which entitled him to their admiration. The general public is in much the same condition with regard to machinery generally.

Lecture Course for an Engineers' Association.

We have frequently alluded to the opportunity that was afforded stationary engineers through their organizations to listen to lectures and bring out discussions at their meetings on subjects relating to matters of interest to them. The regular business at such meetings need occupy but a few minutes of time, leaving, practically, the entire evening for lectures and discussion, thus providing one of the best educational courses that we know of in connection with any similar organization or society. It is true that all the subordinate associations of N. A. S. E. do not give this the attention it deserves, sometimes appearing to forget that the objects of the association are purely educational and charitable. But if they are not all so forward in this as could be hoped there are some that are taking full advantage of their opportunities. A recent evidence of this comes to us through the courtesy of Mr. William Waddell, of No. 2, of Cincinnati, O., in the form of a neat little programme, giving the date for a lecture or discussion, and the subject, for each week up to and including December 20.

The lecture list embraces the names of well-known engineers and professional men and a remarkably interesting list of subjects, and the questions to be discussed are of equal interest. We heartily commend the example of No. 2 of Cincinnati to all other associations in the country. We are not surprised to hear that it is in a very flourishing condition. In the programme are some remarks by Mr. Waddell to the members that are so pertinent—so replete with good sense—that we publish them on another page.

No Special Tax on Machinery.

It is proposed in some quarters to levy a special tax upon bicycles; a proposition which we think should be opposed by every person, especially those who are interested in machinery, or who believe that when a way of doing a thing by machinery better than it has previously been done by unaided muscle is discovered, the use of the machinery should be encouraged rather than discouraged. It is said to have been demonstrated that with a first class bicycle a man travels on good roads six miles with about the same expenditure of muscular force as he would expend in walking one mile. Many mechanics and workmen are using the machines to go back and forth to work, and are enabled by their use to live in more favorable locations than would otherwise be practicable; the industry of building the machines has become a large and important one, and there can be no possible good result from a discouragement of their construction and use, by a special tax. If special taxes must be levied let them be placed upon things which it is good public policy to discourage the existence or use of—such, for instance, as bachelors or yellow dogs.

It Was Not an Advertisement.

We have received the following letter which we publish for the purpose of correcting the misapprehension referred to, if any such really exists:

Providence, R. I., May 22, '93.
AMERICAN MACHINIST PUBLISHING CO.,
203 Broadway, New York, N. Y.

Gentlemen:—You may be interested in knowing that your notice of our new pamphlet is creating quite a demand for the books, no less than 60 being asked for to-day, with reference to your paper. Quite a number of people speak of the notice as an advertisement, and we have thought that you might like to know this so that at some time you might indicate that these references are not paid for, but represent your own judgment of the books reviewed.

We are, yours truly,
BROWN & SHARPE MFG. CO.

Regarding the foregoing, we make the statement every week in the first column of page eight to the effect that nothing is published in our reading pages in consideration of pay. This statement is made absolutely without reservation. Everything that appears in our reading columns, whether a book notice or other matter, is there because in our judgment it will be of interest to our readers, and for no other consideration. A notice of the little book referred to by Brown & Sharpe Mfg. Co., appeared in our issue of May 18 because we were interested in it and instructed by it, and we believed that others would be.

The New York Central Railroad—or its management—has shown its ability to make very fast runs with passenger trains. In our issue of May 18 we referred to a run in which a speed of better than 112 miles per hour was said to have been made. The information as to this seemed at that writing to be authentic, but since then a good deal of doubt, in which we share, has been thrown on the stated performance. We were misinformed as to the use of the speed indicator on the engine, for one thing, and a careful consideration of all the conditions make the speed given seem improbable. The fast run that was to have been made between New York and Buffalo, which we referred to in our issue of the date mentioned, was not made.

Undoubtedly some very fast time has been made by the Central train, but after all, the demonstration of the fact that fast time can be made in little spurts, or in special instances, is not of much importance. The question that interests the traveling public is how much the time between distant points, as between New York and Buffalo, or Chicago, can be shortened. Ten or twelve years since we saw a stationary engine capable of developing considerable power—the cylinder was seven inches in diameter—run for a few minutes at the rate of 1,300 revolutions per minute, and it turned over very smoothly indeed, but we do not know of any one to day who is building reciprocating stationary steam engines to be run regularly at that speed.

Literary Notes.

A MANUAL OF MACHINE DRAWING AND DESIGN. By David Allan Low (Whitworth Scholar), M. I., Mech. E., Head-master of the People's Palace Day Technical School, London, and Alfred William Bevis (Whitworth Scholar), M. I., Mech. E., Director of Manual Training to the Birmingham School Board.

This work treats mainly on the proportioning and designing of machine details, such as screws, bolts, nuts, keys, cotters, pipes and pipe joints, shafting and shaft couplings, supports of shafts, belt gearing, rope gearing, friction gearing, toothed gearing, cranks, crank-shafts, eccentrics and other details of engines and boilers. In the introductory chapter, besides several brief articles on drawing appliances and the making of working drawings, there is a collec-

tion of problems in practical geometry, but by no means as many as will be required in every-day practice. Chapter II. contains brief statements of various principles and rules of mechanics; these are inserted more for the sake of reference than for the purpose of teaching those principles.

The rules for proportioning and tables are based on scientific principles and actual practice. The illustrations and descriptions of a great variety of machine details are well adapted for reference, and will to some extent at least take the place of an engineer's note-book which the young engineer and draftsman does not generally possess. The dimensions are marked on many of the illustrations, and these may serve as drawing examples for students, examples ranging in difficulty from the simplest machine details to a set of triple-expansion engines; but these are not, as a rule, accompanied by any definite instructions in drawing, and it cannot be said that the book gives instruction in drawing, as might be inferred from its title.

The subjects are concisely stated and discussed, and no one who is anxious to learn should have much difficulty in solving the problems given and applying the underlying principles to similar problems which present themselves in every-day practice. The authors have succeeded in bringing out an excellent work which we can recommend to mechanics who wish to extend their knowledge in correct designing, and to young engineers who wish to advance in their profession. The book is published by Longmans, Green & Co., 15 East Sixteenth street, New York. Price, $2.50.

We have received a bound copy of Vol. IX. of the Transactions of the American Institute of Electrical Engineers. It gives the report of ten meetings held during last year. The papers read, and the discussions are of the greatest general interest and importance, the whole forming a volume of which the society has every reason to be proud, and one of extreme value to all who possess a copy. It is published by the Institute at its office, 12 West Thirty-first street, New York City.

The Providence & Stonington Steamship Company has had prepared by Mr. Henry Whittemore a pamphlet entitled, "The Past and the Present of Steam Navigation on Long Island Sound." It is a very interesting little book, going into the invention of the steamboat, with cuts of first and ancient examples, followed by the growth of steam navigation on the Sound. The engravings for this part of the work are numerous and very fine.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(267) H. P. H., South Bay City, N. Y., asks: Is there a U. S. standard for punches, dies, couplings, etc.? *A.*—We know of no U. S. standard which is recognized as such by all manufacturers.

(268) M. M., ——, writes: Please inform me if there is a school in which I can learn the machinist's trade. *A.*—The best and only schools, that we know of, in which the machinist's trade can be thoroughly learned, are machine shops; first-class jobbing shops should be preferred.

(269) O. V. V., New Orleans, La., writes: Please let me know the horse-power of a condensing compound engine with cylinders 2½, 5, x5 inches, stroke; boiler pressure, 100 pounds. *A.*—When running at the rate of 400 revolutions per minute we should rate the engine at 6 indicated horse-power.

(270) E. C., Dover, N. H., writes: Kindly give me the title of a book which treats on the manufacture of steel, especially Bessemer steel. *A.*—"The Metallurgy of Steel," by H. M. Howe, is the most complete book treating on this subject, but it is somewhat expensive. You may get cheaper works of a more elementary character; for these, send to any dealer in scientific works for a catalogue for a selection.

(271) W. A. T., New Bedford, Mass., writes: Please inform me in regard to the numbers and corresponding diameters of machine screws, number of threads per inch, etc. I think if you were to publish a table relating to the above it would be of interest to a number of your subscribers in this locality. *A.*—You will find all this information and tables in our issue of August 18, 1888.

(272) L. S., Minneapolis, Minn., writes: I have to work on cast iron plates of about 3x5 inches and ⅛ inch thick The cast-iron is mostly too hard to work. Could you give any method or receipt for making them soft? I know there is a way, but cannot find it. *A.*—See answer to Question 193 in our issue of April 20, current volume. The best and cheapest way is to get castings soft enough so that they can be worked.

(273) J. P., Cincinnati, Ohio, writes: Suppose a ball of wood and a ball of iron, each weighing five pounds, were dropped at the same time from a given elevation, which would reach the ground first? *A.*—In vacuum they would reach the ground at the same time; but falling through air, the wooden ball, on account of its greater diameter, has to overcome a greater air resistance, and, therefore, it will reach the ground last.

(274) C. H., Madison, Wis., asks: What is the duty of a back pressure valve, and what is the duty of an equalizing valve? *A.*—When the exhaust steam from an engine is used for heating or other purposes, a back pressure valve is used; the duty of valves of this kind is to prevent the back pressure in the engine cylinder exceeding given limits. The duty of equalizing valves is to equalize the pressures in two given vessels.

(275) G. M., Cleveland, Ohio, writes: A prominent manufacturer of hoisting machinery in Chicago shows in his catalogue two brake bands on one drum operated simultaneously by one foot lever. Does he get more efficient friction than he would with one band? *A.*—On general principles he will not obtain any more friction with two bands than with one, but with two bands the wear in a given time will be considerably reduced. The particular design of the hoisting machine may require two bands for other reasons than simply reducing the wear, but on this we cannot express an opinion without seeing the machine.

(276) H. M., Holyoke, Mass., writes: Please inform me if there is any college where I may get a technical education for my services. I am a first-class pattern maker, and a fair draftsman, age, 28, but I have not received the education which I should have to make more headway in drawing. *A.*—In answer to Question 239 in our issue of June 2, 1892, you will find the names of a number of technical institutes; write to any or all of these stating your case. In this way you may find an institute in which your services will be acceptable for the education you receive. It seems to us that if you desire simply to make headway in drawing, the papers treating on this subject, which were concluded a few years ago in our columns, will be of aid to you.

(277) W. J., Florence, Mass., writes: Please let me know where I can obtain some soft metal like babbitt suitable for pattern work, but which will not shrink when cast. *A.*—We do not know where you can obtain a soft metal which will not shrink when cast. It is said that the following alloy will not contract when cooling—10 pounds of lead, and 2 ounces of antimony. The antimony is added when the lead is in a state of fusion. The antimony gives hardness to the lead, but prevents its contraction when cooling. This alloy you can procure in any brass foundry. 2. Of what is the so-called white metal composed which is often used by pattern makers for patterns? *A.*—There are a number of alloys called white metal, and the kind to be adopted will depend much on the form of pattern The following may answer your purpose: 10 ounces lead, 6 ounces bismuth, and 4 drachms of antimony; or, 2 pounds of antimony, 8 ounces of brass, and 10 ounces of tin.

(278) B. J. H., Providence, R. I., writes: I wish to put steam power to a set of shears which are now worked by hand. I can only attach one cylinder; what diameter and stroke should it be to lift 25,000 pounds, steam pressure 40 pounds? (Our correspondent then gives the sizes of wheels in the train of gearing which we do not repeat here as they are not required for the solution of the problem.) *A.*—You have left out one very important item, and that is the speed with which the load is to be raised. Assuming that 20 feet per minute is satisfactory, the work that must be performed per minute is $25{,}000 \times 20 = 500{,}000$ foot-pounds, and this is equal to $\frac{500{,}000}{33{,}000} = 15$ horse power; adding 20 per cent. for friction, we have $15 \times 1.20 = 18$ horse power which must be developed by the engine. With a mean effective pressure of 30 pounds per square inch of piston, and piston speed of 400 feet per minute you will need a cylinder 8 inches diameter and 12 inches stroke. 2. Would you recommend a heavy fly-wheel? *A.*—The fly-wheel need not to be very heavy.

(279) E. B., Erie, Pa., writes: In your issue of March 2 there is a question relating to Sellers planer. I fail to see how the average cutting speed can be 14.4 feet per minute; I would like to be enlightened. Is not one-fourth of the time consumed on the return which would make the speed 13 5 feet per minute, neglecting time lost in feeding and reversing? *A.*—It is true that the return is made in one-fourth of the time of the cutting speed, but it is wrong to take ¼ of the cutting speed for the speed of the continuous cut. The cutting speed is given at 18 feet per minute; now assume, for the sake of clearness, that we have a piece 18 feet long to plane, in cutting, the tool will require one minute to pass over this distance, and in returning ¼ minute will be required, therefore it takes 1¼ minute to cut through a distance of 18 feet, or $\frac{18}{1\ 25} = 14.4$ feet per minute for the continuous cut. The correctness of dividing 18 by 1.25 is shown in the following proportion:

1.25 : 1 :: 18 : continuous cut per minute.

(280) A. S., West Duluth, Minn., writes: Please inform me of a book, and where it can be obtained, which contains simple rules for computing the gearing of a lathe for cutting screws. *A.*—Applied Mechanics, by A. Jamieson, recently published, treats on this subject in a simple manner. This book may also be useful to you in many other ways. It can be obtained from any dealer in scientific works. 2. Where can I get a list of sizes of tap drills? *A.*—You can readily make a list yourself by the following rule: Divide the constant 1.299 by the number of threads per inch, subtract this quotient from the outside diameter of the thread, the remainder will be the diameter at the bottom of the thread. Expressing this rule in symbols, we have,

$$d = D - \frac{1.299}{n},$$

in which d denotes the diameter at the bottom of thread; D, the diameter outside of thread; and n, the number of threads per inch. The size of drill should be made equal to the diameter of the bottom of the thread or to the nearest $\frac{1}{32}$ of an inch. The above relates to the Franklin Institute standard. For sharp V threads the diameter at the bottom of the thread is found by the following formula:

$$d = D - \frac{1.733}{n},$$

in which the symbols denote the same quantities as before. Two-thirds to three fourths the depth of the thread is generally considered about right for cast-iron.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Grant's gears, Lex'n, Mass., & Phila., Pa. See p. 11.

Shafting Straighteners J. H. Wells, Tampa, Fla.

Ideal Drawing Stands. M. C. Hammett, Troy, N.Y.

Forming Lathes Mer. Mach. Tool Co., Meriden, Ct.

Air Hoists, Frank Richards, Box 3686, N. Y.

Milling Machs. Kempsmith M. T Co., Mil., Wis.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Drill Presses, with Tapping Attachments.
Gould & Eberhardt, Newark, N. J.

Davis Key Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

Pulley lathes, most efficient offered. The Lodge & Shipley Machine Tool Co., Cincinnati, O.

Engine Castings, Humphrey's Foundry, Bellefontaine, O.

For Cypress Tanks and Vats, address W. E. Caldwell Co., Floyd and Main Streets, Louisville, Ky.

$5 gauge shows speed and all changes of eng's, mach'y, etc. C. T. McL. & Co., 120 Fulton St., Boston.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

"Shapers (Double Triple Quick Stroke")
Trade Mark.
Gould & Eberhardt, Newark, N. J.

For the Latest Improved Diamond Prospecting Drill address the M. C. Bullock Mfg. Co., corner Canal and Washington Sts., Chicago, Ill.

Gear and Rack Cutting, Drawings for Bevel & Miter Gears, Cutters for Spur & Bevel Gears Milling Cutt's, Vert'l Mill'g Mach's. R.M.Clough, Tolland, Ct.

"Pumping Machinery." New book, 450 pp, 8vo, 270 Eng. Prospectus free W. M. Barr, 3223 Powelton Avenue, Philadelphia Pa.

Builders Iron Foundry, Providence, R. I., Mortar Mounting, and 2 – 12" B. L. Rifled Mortars in front Govt Bldg., Chicago. Pamphlets on application.

Gear Cutters, Auto. Specially adapted for Motor Gears and all other style Gears
Gould & Eberhardt, Newark, N. J.

Passaic Art Casting Co., 35 Warren St., N. Y. Finest Castings in the world. Brass, German Silver, Aluminum, etc. Patent Pressure Process. Machinery Name Plates.

Patent Soliciting of High Class.
D. Walter Brown, Counsel in Patent Cases,
111 Broadway, New York.
Send for Brief History of Patent Legislation.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

"Binders" for the AMERICAN MACHINIST. Two styles the "Common Sense," as heretofore sold by us and mailed to any address at $1 00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING CO., 203 Broadway, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

Columbian Exhibition Notes.

(*Continued from page 3.*)

coming and in cost of living while here. Speaking generally Chicago people seem to have become imbued with the idea that this is the time to make a fortune, and those who control space anywhere near the grounds or in accessible locations up in the city, have generally anticipated and based their charges upon the amount of business presumably to be done upon that space during the summer. Those who have sufficient faith in the enterprise to pay these charges in the shape of rents or leases for the season are themselves "stuck" unless they can charge high prices and do lots of business Some of them will make money, but many of them will probably lose money, and in any event it seems likely that visitors will have to pay "all the traffic will bear," which may mean more or less as the season advances and the measure of people's desire to visit the exhibition is ascertained.

The Wellington Catering Company, for instance, which controls the restaurant and lunch counter privileges within the grounds pays 25 per cent. of its gross receipts to the Fair Management. In one corner of the Machinery Hall it has a space fenced off, within which are counters made of boards not fit for pattern lumber, roughly constructed, and with rude and uncomfortable stools in front of them. Here you can get things to eat and drink by paying the prices of a first-class restaurant, which this is not, as is perhaps best indicated by the fact that there is no bill of fare, and you use your coat sleeve or anything else you may choose for a napkin. No other eating facilities are provided within the Machinery Hall, but in the Electricity building near by is a very good restaurant, run by the same company, where the service is good and the prices not much, if any, higher than in other equally good restaurants in any large city. Outside the grounds eatables can be had at all prices, and I noticed one place on 63d street which advertised in the window "a square meal; all you can eat for 25 cents." I also noticed a lot of tents pitched upon a vacant lot near the ground in which sleeping accommodations were announced at 50 cents per night. There are lots of what are called "shacks," however, which are mere shells of the poorest and cheapest frame construction, many stories high, and with very small and mean rooms, for which very high prices are asked, and there are cases where people who own private houses near the grounds are asking $2 to $3 per day per person for rooms in which they intend to put two to four persons together, and not very large or fine rooms either.

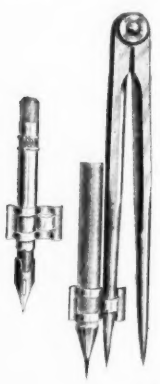
Altogether it seems probable that neither the railroads nor the people of Chicago have yet discovered just how badly people want to come to the Fair. They have made the ante high to begin with, apparently with the intention of being sure not to make the

mistake of putting it too low until they see how things are coming out.

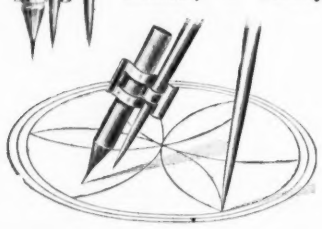
As stated at the start, the Fair is going to be well worth visiting, and it will be the proper function of the AMERICAN MACHINIST, besides giving some account of the features of it which will be of special interest to its readers, to give them information as to when it will be most advantageous to come here. F. J. M.

The Simplex Drawing Compass.

The accompanying illustrations show a new drawing compass designed for rough usage, but with which accurate work can be done, and is well adapted to such work for which the ordinary delicate draftsman's instruments are not desirable. Its simplicity and stiffness recommend its use to machinists, pattern makers, carpenters, and for use in the lower classes in public schools.



The compass has hardened points, and the pencil, which is of the ordinary commercial form and of any desired grade or fineness, is readily attached by means of a clasp as shown. An ordinary writing pen is employed for inking in. The pen is held by a rubber-tipped, nickel-plated holder, which is attached to the compass in the same way as the pencil.



The compass is sheathed for carrying it in the pocket by pushing one point into the pen-holder, and the other through its clasp, making the rubber end serve as a protecting end.

The nickel-plated clasp, which can be obtained separately, is also useful as an attachment to the end of a pencil so as to prevent it from rolling off a desk or drawing board.

These instruments are manufactured by W. H. Honiss, Hartford, Conn.

Armored Cruiser "New York."

The official trial trip of the new armored cruiser "New York" took place on the 22d ult. The results of the trial are exceedingly satisfactory, both to her designers and builders, and gratifying to all who are in any way interested and take pride in the building of our new navy. The fast speed attained, and the smooth working of the machinery, without a single hitch during a severe trial of nearly four hours' duration, gave every evidence that the designing of the new navy is placed in the hands of engineers of experience and ability; also that we have conscientious and capable builders. The trial trip was made over a measured course, and the speed attained, as approximately calculated, was 21.1 knots; but corrections for the tidal influences may change this a little. The engines ran at an average speed of 135 revolutions per minute, and developed about 17,000 horse-power.

The propelling power is furnished by twin screw engines. There are four of these engines, two for the starboard screw, and two for the port screw, arranged so that one of the engines on each shaft can be disconnected, and the vessel allowed to cruise under half power. The engines are of the vertical, inverted cylinder, direct-acting, triple-expansion type; the cylinders are 32, 46 and 70 inches diameter, and 42 inches stroke. Steam is furnished by six tubular boilers, with four corrugated furnaces in each end. The diameter of each boiler is 15 feet 3 inches; they are 21 feet 3 inches long. The diameter of each furnace is 3 feet 3 inches, and the length of grate is 6 feet 4 inches. The total heating surface in each boiler is 5,198 square feet, and the total grate surface is 134 square feet; the ratio of heating to grate surface is 31.6. These boilers are built for a steam pressure of 160 pounds. There are also two auxiliary boilers 10 feet diameter and 8 feet 6 inches long. Each has two corrugated furnaces 2 feet 9 inches diameter, with grates 5 feet 10 inches long.

The cruiser is provided with an entire outfit of Blake pumps of special design, including the air pumps for the main engine. She is lighted throughout by electricity, and every convenience for health and comfort for those on board has been provided.

In designing the "New York" it was the evident intention of the government to build a vessel that would compare favorably with any armored vessel afloat, and we believe that in this all expectations have been realized.

A correspondent is desirous of knowing how to make the plan of profit-sharing work in a general jobbing shop—machine shop, foundry, blacksmith shop, boiler shop, etc., we suppose is meant. If some reader has had actual and successful experience in this, we shall be glad to publish the plan and results.

A correspondent writes us: "I have been interested in the catalogue discussion, and wish to enter a protest against paging at the bottom of pages. Put the number of pages at the *top* of page where it will be easily seen."

MANUFACTURES.

The Lockport (N. Y.) Company is adding machinery.

The plant of the Asbestos Pulp Co., Governeur, N. Y., is to be repaired.

A new boiler house is to be added to the Carrecabe mill, Milton, N. H.

The Berger Manufacturing Company, of Canton, O., will enlarge its plant.

The Wentzel Paper Company, of Oella, Md., is making repairs in its mill.

The Diamond Plate Glass Company, of Elwood, Ind., will enlarge its works.

A hat factory is to be started by out of town parties at Washington, R. I.

Caldwell boilers are being installed by the Taylor Mfg. Co. at Reynolds, Ga.

The Menzel Foundry Company has formed, with $50,000, at Minneapolis, Minn.

A company is to be incorporated to build a fiber factory at St. Petersburg, Fla.

A new glass plant is to be erected by the green bottle combine at Webster, Pa.

The Columbia Iron Company, of Columbia, Pa., will erect an addition to its mill.

The National Metal and Electrical Company has been organized at Cleveland, O.

The Pond Machine Tool Company, of Plainfield, N. J., is adding a new structure.

An additional story is being built on the Commercial Knitting-mill, Troy, N. Y.

A new machine shop for the Eastern Forge Company, of Portland, Me., will be built.

The Columbia Scale Co., Pleasant Hill, Mo., capital stock $7,000, has been organized.

The Crescent Brush Manufacturing Company has been organized at New Orleans, La.

The Pittsburgh (Pa.) Welding Manufacturing Co. has been formed, with capital $10,000.

H. Powell Ramsdell is building an addition to his paper-mill at Salisbury Mills, N. Y.

The Abatis Electric Mfg. Co., Chicago, Ill., has been organized, with a capital $50,000.

Rambo & Regar, of Norristown, Pa., will erect an addition to their cotton-hosiery-mill.

J. R. Kingsland, of Franklin, N. J., will make alterations and improvements in his mill.

The Riverside Woolen Co., Stafford, Conn., is building a two-story addition to its plant.

The Valley Falls Worsted-mills, Providence, R.I., are adding new machinery to their plant.

D. W. Ellis & Bro. are to rebuild their woolen-mill recently burned at Wilbraham, Mass.

Work will soon be commenced on the new mill to be built by the Wing Bros., at Old Town, Me.

The Gilette-Herzog Co., of Minneapolis, Minn., will erect a foundry building a at cost of $25,000.

The Newberry (S. C.) Cotton-mills will erect an additional building and put in 15,000 spindles, etc.

Bath (Me.) parties will erect a building 50x40 at Newport, to be used as a spring bed manufactory.

In Kenova, West Va., J. W. Shank and F. F. McCullough have incorporated the Kenova Excelsior Co.

A shirt factory, to employ about 500 people, is to be constructed at Island Pond, Vt., by George Gane.

The Farrand Lock Co., capital $100,000, has been organized in New York for the manufacture of locks.

The Union Iron Works, of San Francisco, Cal., have had plans prepared for a new forge and works.

The Windsor Locks (Conn.) Electric Lighting Company will increase the capacity of its plant, it is said.

The Eureka Emery Wheel Company, of Buffalo, N. Y., has been formed. The capital stock is $25,000

Varney & Nutting is the name of a new firm formed at Skowhegan, Me., for the manufacture of caskets.

The American Paper Goods Co., of Kensington, Conn., will increase its capital stock from $175,000 to $250,000.

J. H. Lakin, Westfield, Mass., has organized a company to erect a casket manufactory at Rivermore Falls, Me.

The capacity of the dyeing and bleaching departments of the Interlaken Mills at Arkwright, R. I., has been increased.

A company has been organized at Durham, N. C., to manufacture a metal wheel patented by W. W. Taylor, of Waco, Ky.

The Patterson Mfg. Co. has been formed at Concord, N. C. J. W. Cannon is president, and J. F. Patterson treasurer.

The Bancroft Vestibule Car Co. has been formed at Chicago, Ill., with capital $1,000,000. to manufacture railroad cars.

The Northwestern Car Company, of Detroit, Mich., has broken ground for a 100x380-foot building at Oshkosh, Wis.

The West Medford (Mass.) Paper Co. has purchased land at Medford, upon which it will build a paper-mill 100x280 feet.

It is planned to erect a pulp and paper-mill on Mouse River, N. Y. Watertown parties are reported to be interested.

The Franzen Paper-mill Co. has been incorporated at Milwaukee, Wis., by William Franzen and Margaretha Franzen.

At Atlanta, Ga., the Georgia Electric Light Co. has arranged for an extension of its plant. The building alone is to cost $16,000.

It is said that the capital stock of the Detroit (Mich.) Sheet Metal and Brass Works has been increased from $100,000 to $150,000.

The Modena Cotton-mills have been incorporated in Gastonia, N. C., by J. E. Curry, L. L. Jenkins and others. The capital stock is $50,000.

The Diamond Machine Co., Providence, R. I., whose shops were recently destroyed by fire, are to build new "fire-proof" buildings.

John Good & Co., of New York City, have broken ground at Ravenswood, L. I., for a building, 475x80 feet, to be used as a binder twine mill.

The Eddy Electric Manufacturing Company, of Windsor, Conn., will put up an addition 150x60 feet in size, to be used for heavy machine work.

The Union Manufacturing Company, of New Britain, Conn., will put up a 70x42 foot addition to their factory at once, according to local reports.

The Shelby Steel Tube Company, of Shelby, O., D. L. Cockley president, will put up two new buildings, one 200x44 feet and the other 36x20 feet.

The National Steel Wheel Company has been organized in Chicago, Ill., with capital stock placed at $250,000, and will erect a plant at Hobart, Ind.

The Centrifugal Metal Company has been incorporated in Chicago, with a capital of $100,000. The incorporators are P. B. Smith, and Thomas H. Noyce.

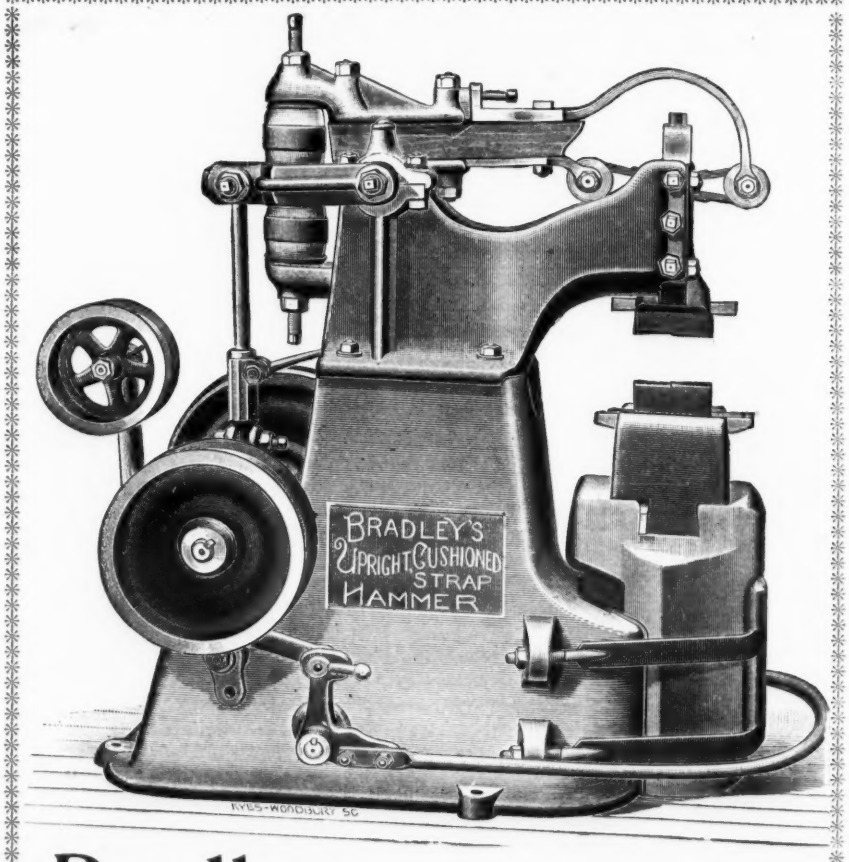
A company to be known as the Sumpter Cotton-mills will organize to erect a factory at Americus, Ga. Charter has been applied for; will have a capital stock of $15,000.

The W. S. Merrell Company, of Cincinnati, O., is to put up a two and three-story building of an L shape, with a frontage on two streets of 270 and 150 feet, respectively.

There is water-works agitation at Quincy, Fla.; Frederick, Md.; Pittsfield, Mass.; Toronto, Can.; Colorado Springs, Col.; West Alexandria, O.; Princeton, Ind.; Tipton, Ind.; Sandusky, O.; Reading, O.; New Bedford, Mass.

The Clark Foundry and Iron Company has been incorporated to do business in Denver, Col., with a capital stock of $50,000. Among those interested are J. S. Clark and D. J. Davies.

The Barker Mine Car and Foundry Company, of Springfield, Ill., has been incorporated with a capital stock of $25,000 by J. W. Black and others to manufacture car wheels, axles and mining cars.



Bradley Hammers.

If you plate, draw, square, taper or weld iron and steel, you need a Bradley Hammer.

If you swage, collar, spindle, or do any manner of die work, a Bradley Hammer will soon pay for itself.

That the Bradley is the best Power Hammer in the market has never been questioned. Our circulars illustrate, describe, give sizes and prices.

BRANCHES: 14 Warren St., New York. 96-98 Sudbury St., Boston.

BRADLEY & COMPANY, Syracuse, N. Y.

The Bridgewater Paper Company has been organized at Kittery, Me., for the purpose of manufacturing pulp. The capital stock is $100,000, and the officers are: Pres., A. Howard, of Chelmsford, Mass.; treas., B. B Holmes, of Bridgewater, Mass.

At Providence, R. I., a new building for manufacturing jewelry has been erected by C. H. Perkins. It is a four-story structure, each floor containing about 13,000 square feet. The machinery will be operated by two boilers of 75 horse-power each and an engine of 80 horse-power.

The Riverdale Cotton Co. has been organized at Great Barrington, Mass., with a capital of $100,000. President and treasurer, J. P. Pomeroy, of Housatonic; general agent, Charles C. Camp; directors, Messrs. Pomeroy, Camp and Frank Curtis, of New York. Work on the buildings will begin at once.

The Penberthy Injector Co., of Detroit, Mich., report that they again have their machinery in motion after a delay of ten days, occasioned by a fire at their factory on May 9th, at which time their entire third floor and roof were burned, and the stock and machinery on two first floors badly dam aged by water. Over 50 carpenters, masons, plumbers, roofers and steam fitters have put in shape in seven days (three used in insurance adjustment) what looked to be a month's work after the fire. They are prepared to fill orders as usual.

The plans for the new plant to be erected in Fitchburg, Mass., by the C. A. Edgarton Manufacturing Co., a corporation organized under Massachusetts laws for the manufacture of webs and suspenders, have been accepted. The company has been engaged in the manufacture of suspenders at Shirley Village for 20 years and are now employing about 200 hands. When in full operation in Fitchburg they expect to employ from 300 to 450 hands, a majority of whom will be women. The officers of the company are C. Fred Edgarton, president and treasurer; F. H. S. Hyde, vice-president; and H. W. Edgarton, secretary.

Machinists' Supplies and Iron.

NEW YORK, May 24, 1893.

Iron—American Pig—We quote Standard Northern brands, No. 1 Foundry, $14.50 to $15.25; No. 2, $13.50 to $14.25; Gray Forge, $12.25 to $12.50. Southern brands of good quality are obtainable at $14.25 to $14.50 for No. 1 Foundry; $13 to $14 for No. 2 and $12 to $13 for Gray Forge.

Antimony—The market is steady. We quote L. X., 10¼c. to 10⅝c.; Cookson's, 10⅛c. to 10¾c.; Hallett's, 9.90c. to 10c., and U. S. French Star, 10½c.

Copper—The market is inactive. For Lake Copper 11c. is generally asked, but 10.90c. or 10.85c. may buy. Casting Copper is held at 10⅛c. to 10¼c.

Lead—The market is quiet. Some business has been done at 3.85c., but most holders are asking 3⅞c. to 4c.

Lard Oil—Prime City is quoted at 85c. to 86c.

Spelter—The market is nominal at 4.25c. to 4.30c. for New York delivery. There are offerings at the first-named figure but no business is reported.

Tin—The market is quiet at 19.85c. for spot, May or June, 20.15c. for July, and 20.35c. for August.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Draftsman (designer), mach. tools, jigs, fixtures, general mach'y, desires pos. H. M., AM. MACH.

Wanted—Foremanship; engines, pumps or general jobbing. Indicator, AMERICAN MACHINIST.

Wanted—1st-class machinists, molders & pattern makers. Munro, Spiro & Wendler, Carthage, N. Y.

Wanted—Position as foreman boiler maker; 12 yrs'. exp.; ref. A1. A. M P., Box 92, Roanoke, Va.

Young mech'l dftsman has had 4 yrs. shop experience and 3 yrs. as dftsman desires position in N. Y. City or vicinity; A1 refs. Draftsman, AM. MACH.

Wanted—An assistant draftsman. Apply by letter to John Rohland, care of Coxe Bros. & Co., Drifton, Luzerne Co., Penna.

Wanted—A 1st-class foreman for machine shop. One experienced in saw-mill work. The McArdle & Sinclair Mfg. Co., New Orleans, La.

Wanted—Steady position by a first-class pattern maker; competent to take charge of shop. Address Pattern Maker, 220 Ruggles St., Boston, Mass.

Wanted—Position as traveling salesman for machine tools one who has been a manufact'r himself & thor. convers't with that line. Box 137, AM. MACH.

City or country. Expert helpers furnished without charge, for carpenters, wood carvers, and wood turners. Small pay acceptable at start. Address 225 E. 9th street, New York City.

Young man, practical machinist, technical education; two years' experience foundry management, wants pos. as sup't of small and growing jobbing shop; best of refs. R. A., AM. MACHINIST.

Wanted—A first-class loam molder; to a thoroughly capable, sober and energetic workman the highest wages will be paid. Address Baltimore, Box 134, AMERICAN MACHINIST.

Wanted—Position for July 1st by young mechanical engineer and draftsman, or at once charge of industrial concern at the World's Fair. Apply Box 135. AMERICAN MACHINIST.

Wanted—A young man with exp. in mech. drawing, to work under instructions of mech. eng., as ass't draftsman. Address, giving ref., and stating exp., and salary expected, Box 119, AM. MACH.

Wanted—1st-class vise and floor hands of large experience; must be sober and industrious. Can secure steady employment. Married men preferred. Morgan Engineering Co., Alliance, Ohio.

A young man with five years' experience in locomotive drawing desires a situation as a detail draftsman in any engineering works; salary $50 a month. Address G. E., AMERICAN MACHINIST.

(*Continued on page 12.*)

Constructive Steam Engineering,
By JAY M. WHITHAM, M. E.
900 PAGES. 795 ILLUSTRATIONS.
8vo, cloth, $10.00.
JOHN WILEY & SONS, - NEW YORK.

NONE OF OUR BUSINESS

but we make it our business to tell you that our MACHINE MOLDED gear wheels made from SPECIAL PROCESS charcoal iron, are the best. If you want the best, you need them. You will be supplied with all necessary convincing data if you write us.

UNION FOUNDRY & MACHINE CO.,
PITTSBURGH, PA.

Ready Made Cut Gears.
Ready Made Cast Gears.
Ready Made Brass Gears.
Gears Made to Order.
Gear Cutting.
Gear Book, 15 cents.
Treatise on Gears, $1.00.
Gear Cutting Machines.
GEORGE B. GRANT,
Lexington, Mass.,
and 125 South 11th St.,
Philadelphia, Pa.

STAR POWER HACK SAW.

The use of Hack Saws for cutting metals has increased a thousand fold, at least in the last ten years, or since the Star blades were first introduced. Before that time England furnished most that were used. Now the world's supply is made in this country. We handle nearly all that are made and know that the demand doubles every 28 months.

About two years ago we begin making a Power Frame for these Star blades, which has proved to be a very great success. The speed and pressure is so regulated that one blade will cut all day long, or say, ten times as much as when used in a hand frame. It will cut all metals up to 4½ inches, round or square, requiring no attention after the work is put in the vise. We can give the names of several thousand Iron Workers who are using these Power Saws, and we think they will all say that the machines are worth to them a great deal more than they cost. It is only a question of a very short time when all iron working shops will have from one to a dozen of these saws in use **Price, $25.**

We are the only Headquarters for Star Hack, Butcher and Bracket Saws.

MILLERS FALLS CO.,
93 READE ST., NEW YORK.

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Meet all requirements more fully and satisfactorily than any other of its competitors.
INVESTIGATION IS NOT COSTLY.
INVESTIGATION IS CONVINCING.
WRITE FOR CATALOGUE TO
THE HACKNEY HAMMER CO.
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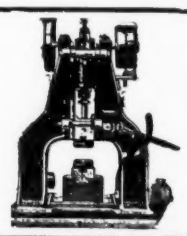

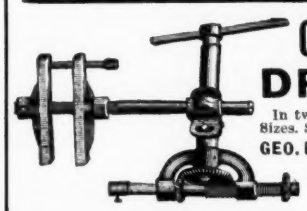

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In two Styles and four Sizes. Send for circular to
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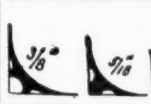
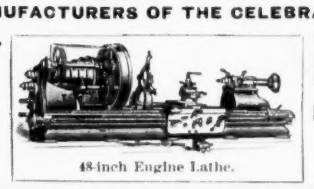
A complete outfit of machine and small tools for engine shop Manufacturers please send catalogues to COLUMBIA ENGINE CO., 809 Tacoma Bld'g, Chicago, Ill.



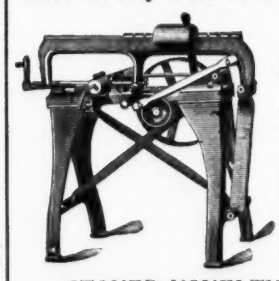
Flexible Metallic Fillet
For Pattern Makers. 8 Sizes.
H. WHITE, 44 N. 4th St. Phila, Pa.

FITCHBURG MACHINE WORKS,
MANUFACTURERS OF THE CELEBRATED
FITCHBURG MODERN ENGINE LATHE
AND OTHER METAL-WORKING MACHINES
SEND FOR CATALOGUE E.


48-inch Engine Lathe.

FITCHBURG, MASS.

Stover Power Hack Saw.
Cuts off any Size or Shape of Metal



UP TO 4½ INCHES.
No skill required to run it. When bar is cut off the machine automatically lifts the saw from the work and stops.
The pressure on the saw is *much greater on the forward stroke* than on the return.
This is the Most Practical Machine for the Purpose ever offered to the trade.
No shop can afford to be without it.
Satisfaction Guaranteed.
Price, $25.00.
STOVER NOVELTY WORKS,
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BRASS-WORKING TOOLS,
SPECIAL MACHINERY.

BARDONS & OLIVER
Cleveland, Ohio.
PRICES on APPLICATION
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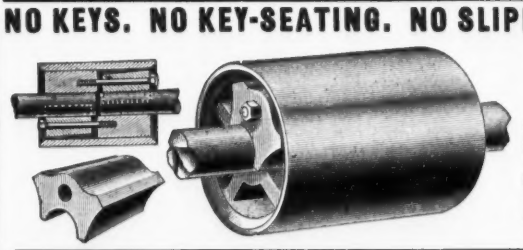
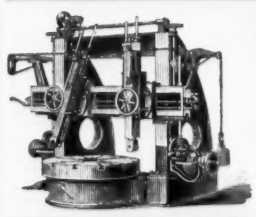
NO KEYS. NO KEY-SEATING. NO SLIPPING. STUART'S PATENT
Compression Wedge Coupling.
SENT ON TRIAL.
Can be attached or removed in a few seconds without injury to shaft or coupling.
SIMPLEST and BEST in MARKET, Also the Cheapest.
Send for discount and illustrated Price List of 20 sizes.
R. J. STUART'S FOUNDRY AND MACHINE WORKS,
NEW HAMBURGH, N. Y.





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COMBINING EVERY IMPROVEMENT.
14 SIZES FROM 5 TO 20 FEET.
BETTS MACHINE COMPANY,
WILMINGTON, DEL.
Chicago Office: 14 South Canal St.

NEW EDITION,
"THE STEAM ENGINE,"
By Daniel Kinnear Clark, C. E., M. I., M. E.
A practical work on Modern Steam Practice, LOCOMOTIVES, MARINE, STATIONARY and PORTABLE ENGINES and BOILERS, valve gear, link motions, triple and quadruple expansion, fuels, &c., &c. 1,500 pages, 1,300 diagrams, and plates drawn to scale. 2 vols., half calf, $16.00. Sent to any address, carriage prepaid. Send for descriptive circular. VIRTUE & CO., 72 Bible House, New York.

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contemplating the expenditure of a large amount in the establishment of a manufacturing industry, requiring the use of a thoroughly equipped Machine shop, Boiler shop, Foundry and Smith shop plant, well located on competing trunk lines of railroads and in a good labor market, is invited to address, STIMSON, WILLIAMS & CO., Bryant Building, 55 Liberty St., New York.

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We publish several mechanical books neatly bound in leatherette and which are authorities on the subjects treated. They are written in plain language. We have sold thousands to engineers. They are not filled with advertisements like most books of this class.

Key to Engineering, 92 pages, 30 cents. Plain questions and answers about steam.
Engineers' Epitome, 135 pages, 50 cents. More mathematical, with formulæ.
Common Sense in Making Steam, 60 pages, 25 cents. For owners of steam plants.
The above three post-paid for $1 00. Stamps taken.
Engineers' Catechism, 192 pages, 25 cents. We have bought the copyright of this book, which is an authority, and was compiled for engineers about to pass examinations.
Key to Engineering (enlarged), 174 pages, 50 cents, containing additional chapters and tables.

Following are from Practical Engineers, unsolicited.

I ENCLOSE ONE DOLLAR for a set of your grand little books on steam, and some day want some of the good steam appliances you make.—A. W. BELCHER, RONDOUT, N. Y., Feb. 4, 1893.

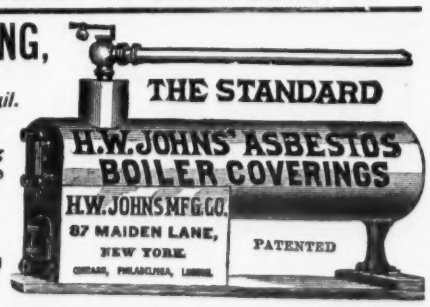
I WOULD NOT SELL "Key to Steam Engineering" and "Common Sense in Making and Using Steam" for $10 if I could not get another.—WM. D. REES, PUEBLO, COLO., Sept. 24, 1892.

MASON REGULATOR COMPANY, Boston, Mass.
W. B. MASON, Superintendent. WALTER G. CHASE, Treasurer.

ASBESTOS CEMENT FELTING,
FOR LAGGING LOCOMOTIVE BOILERS.
Samples and Descriptive Price List Free by Mail.

We are prepared to take Contracts for applying Steam Pipe and Boiler Coverings in any part of the United States.

H. W. JOHNS MANUFACTURING CO.,
87 Maiden Lane, NEW YORK.



✻WANTED✻

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Wanted—A young energetic draftsman who has had shop experience and is well grounded in first principles of steam & mech'l eng'g. Apply by letter only to Clark Thread Co., Box 154, Newark, N.J.

Wanted—A foundry foreman; must be a man of experience who is capable of producing the highest class of machinery castings; cylinders a specialty; give references, age, experience and salary expected Address Box 136, AMERICAN MACHINIST.

Wanted—A few young men having had some machine shop practice can find steady employment at fair pay by applying with references to the undersigned; also two or three expert tool makers wanted. L. S. Starrett, Fine Tool Maker, Athol, Mass.

Young Norwegian, graduate of technical college in Norway and with some practical experience in ship designing in the navy yard at home, desires position as draftsman with a ship-building firm; salary moderate. Address Navy, AM. MACHINIST.

A mech. draftsman, Cornell grad., with exp. in drafting, mach. shop pract., erect'g & test'g auto. engines, desires position. Box 129, AM. MACHINIST.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd lathes & planers S. M York, Clev'd, O.

Auto. Steam Flue Cleaners. Kelley Co., Erie, Pa.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz. Schumacher & Co., Cincinnati, O

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

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1 15 in. x 8 ft. Jones & Lamson, Rise and Fall Rest.	Good order
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1 18 in. raised to 36 x 8 ft. Farmer, Plain Rest.	A1 order

PLANERS AND SHAPERS.

2 18 in. Lathe & Morse Crank Planers.	A1 order
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2 24 in. Hendey Friction Shapers.	A1 order
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MISCELLANEOUS.

1 No. 4 Stiles Power Press.	Good as new
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1 No. 1 Brown & S. Universal Miller.	A1 order
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3 Slate Sensitive Drills.	A1 order
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700 New and Second-hand Tools in stock. Write for complete list, Photographs and Prices.

THE GARVIN MACHINE CO.,

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SECOND-HAND AND NEW MACHINERY

84x84x16½ ft. Planer. Niles Tool Works, two heads.

Planers.	62 in x22 ft.	Planers.	25 in. x5 ft.
"	44 in. x16 ft.	"	24 in x5& 6 ft.
"	36 in x12 ft.	"	24 in. x4 ft.
"	31 in x8 ft.	"	22 in x5 ft.
"	26 in. x7 ft.		

80 in. x18 ft. Engine Lathe Geared Face Plate.
60 in. x45 ft. Double Engine Lathe.
52 in x35 ft. Engine Lathe Horizontal Boring Machine, one end.
30 in x28 ft. Pond Machine Tool Co Shafting Lathe.
36 in. x16 ft Engine Lathe.
34 in. x27 ft. " "
32 in. x12, 14, 16, 18 ft. Bed. New Engine Lathe.
28 in. x22 ft. Engine Lathe cheap.
25 in. x12, 16, 20 and 24 ft. Bed. New do do
21 in. x10, 12 ft. Bed. do do do
20 in. x 5, 6, 8 & 12 ft. do 2d Hand do do
18 in. x 6, 7 & 8 ft. do New & do do do
17 in. x 8 ft. do do do do
16 in. x 6 & 8 ft. do do do do do
15 in. x 6 & 8 ft. do do do do do
14 in. x 6 ft. do do do do do
Car Axle Lathe, Bement. | Driving Wheel Lathe 88 in.
15, 16, 18, 25 in. Crank Shapers. | Wheel Quartering Mach.,
20, 24, 26 & 30 in. Geared Shapers. | Double right and left hand.
20, 22 24, 28, 30 & 36 in Drills. | No. 0 Turret Lathe, Am Tool and Mach. Co.,
Bolt Cutters. | 24 in. Swing, 8 ft. Bed.
8 and 13 in. Stroke Slotters.
Lot of Lincoln Pattern Millers and No. 1 P. & W. Millers.
2 Spindle Drills. Garvin. No. 75 Bliss Press Geared.
Gear Molding Machine. Stamping Press, Bridgeport.
1100 and 3000 lb. Bement Steam Hammer.
100 lb. Steam Hammer.
40 H. P. Vert. Engine. N. Y. S. S. P. Co. | SEND FOR MAY LIST.
11 in. x18 in. Hor. Engine. A1 Order.
16 in x42 in. Corliss and 16 in. x48 in. Brown Eng.
300 H. P. Westinghouse Comp'd Engine.

GEO. PLACE MACHINE CO.,

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ENGINE LATHES.

13 in. x 6 ft.,	Complete. Cpd. Rest and Cross Feed.	Improved style
14 in x 6 ft.,	do	Prentice, Hendey and Fitchburg
16 in. x 6 ft.,	do	Hendey Fitchburg and Prentice
18 in. x 8 ft.,	Improved style, Cpd. Rest and Cross Feed.	
18 in. x 8 ft.,	Complete, Norton. Improved style. "New features."	
18 in. x 8 ft.,	do New heavy pattern.	Fitchburg
21 in. x 8-10 ft.,	do Cpd. Rest and Cross Feed.	
21 in. x10 ft.	do do do do	Perkins
22 in. x10-12 ft.	do Improved style. Ex. heavy.	
24 in. x12-14 ft.,	do do do	
28 in. x16 ft.,	do do do	
30 in. x18 ft.	do Old style. Fair order. Cheap.	
96 in. x16 ft.,	Triple geared. Good order.	

PLANERS.

21 in. x 5 ft.,	Complete. Fair order. Cheap.	
24 in. x 6 ft.	Improved style	
28 in. x 6 ft.,	Complete. Good order. Cheap.	
30 in. x10 ft.,	do Modern style. Ex. heavy.	A1. order.
36 in. x12 ft.,	Ext. heavy.	Powell

SHAPERS.

6 in.	Stroke. 22 in. Feed "Crank"	Good order.	Cheap.
8 in.	do Crank.	Good order.	Gould
9 in.	do do	Extra heavy.	Hewes & Phillips
13 in.	do do	do Good order.	
14 in.	do do	Trav. Head. Improved style.	Fitchburg
15 in.	do do	"New Improved Style."	
24 in.	do do	Ex. heavy. Good order.	
22-26 in.	do Triple Geared. Improved.		

MISCELLANEOUS.

Radial Drills, 3, 4, 5 and 6 ft. Arms. Improved.
Upright Drills, 20, 21, 25 and 32 ins. Prentice.
Upright Boring and Turning Mill 36 in. A1.
Brown & Sharpe Vertical Turret Machine. A1.
Universal Milling Machine. Improved. "New features."
Milling Machines. Standard sizes. Improved.
Screw Machine 15-16 in. Back gears Auto. feed, Chuck and Tools Complete Jones & Lamson. A1.
Tool Grinder and Auto. Knife Grinder.
Boiler Bending Rolls 8-10 ft. "Improved style." A1.
Long & Allstatter, Punch and shears, small size.

J. J. McCABE,

SUCCESSOR TO
E. P. BULLARD'S
N. Y. Mach'y Warerooms, | **14 Dey St.,** NEW YORK.

VANDERBEEK'S
COMBINED UNIVERSAL BORING AND MILLING MACHINE.
BORES ACCURATELY TO .001"
WITHOUT JIGS.
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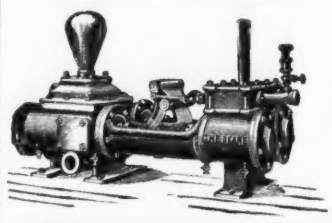

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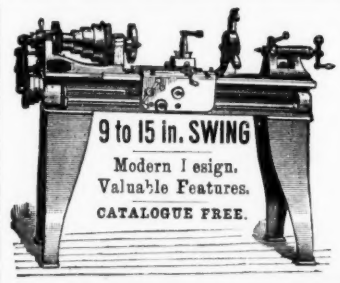

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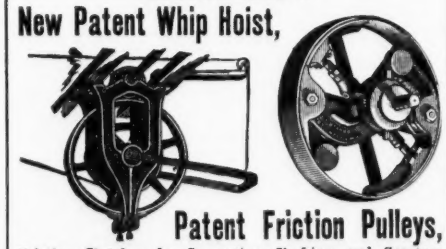

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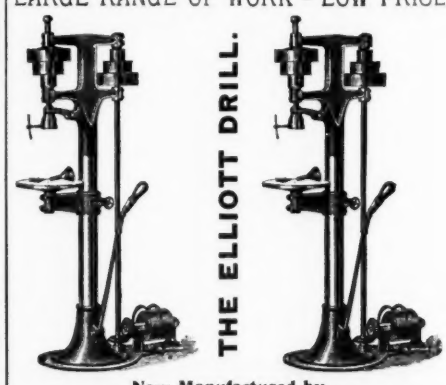

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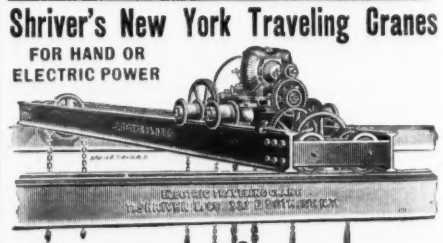

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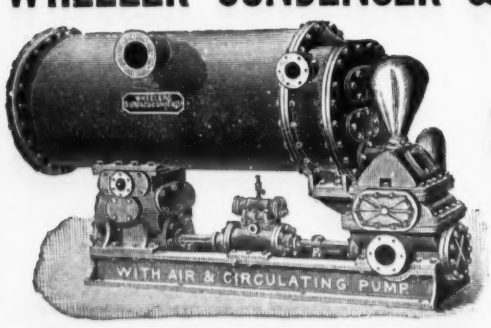

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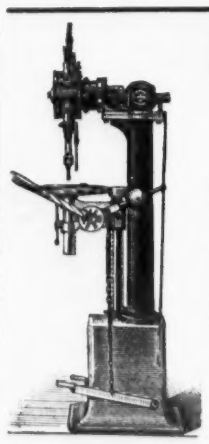

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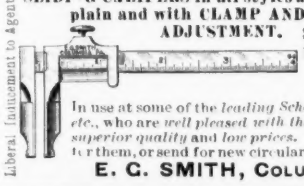

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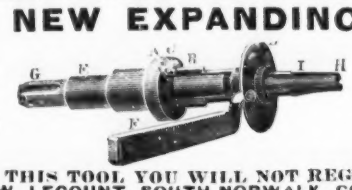

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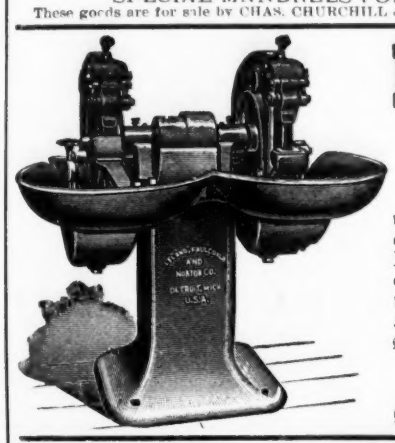

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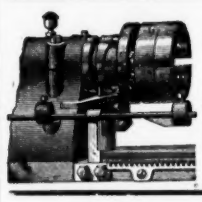

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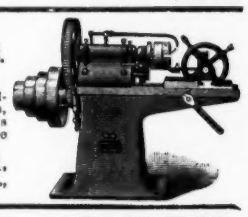

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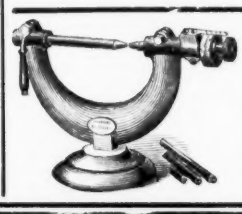

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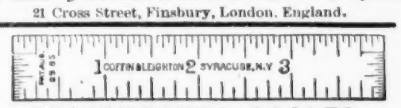

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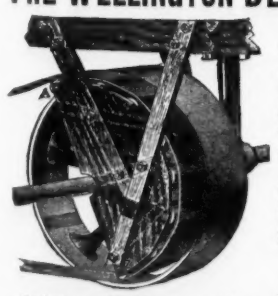

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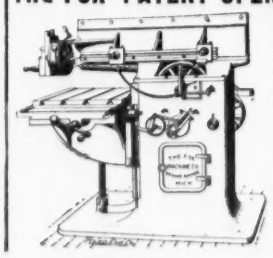

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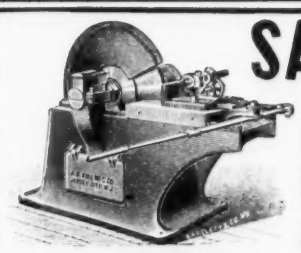

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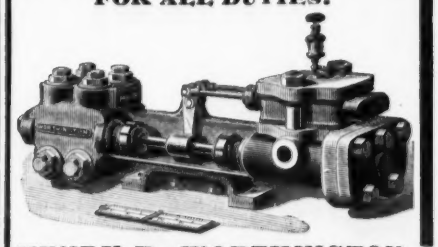

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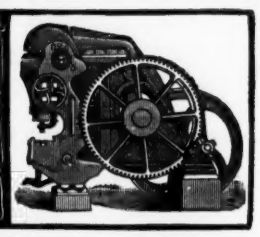

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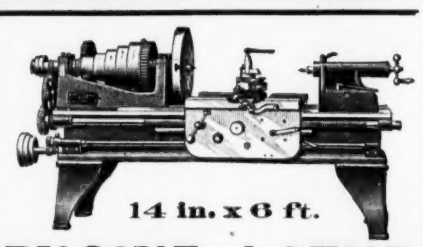

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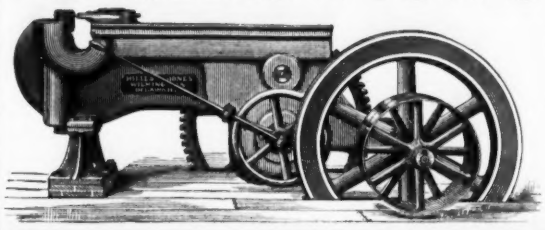

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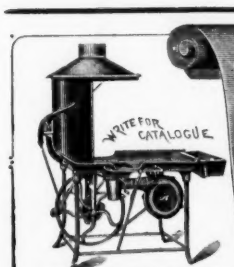

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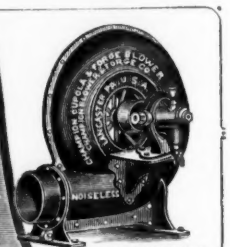

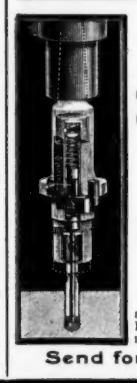

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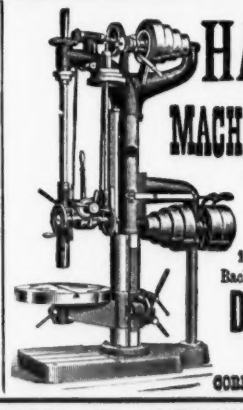

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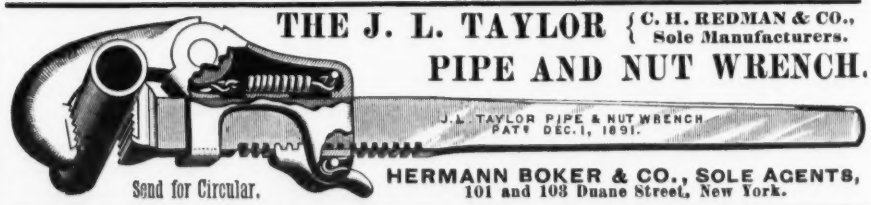

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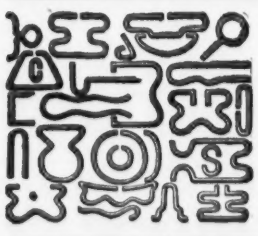

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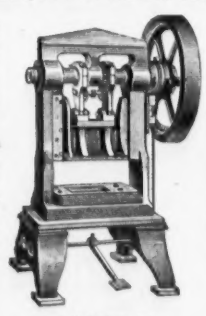

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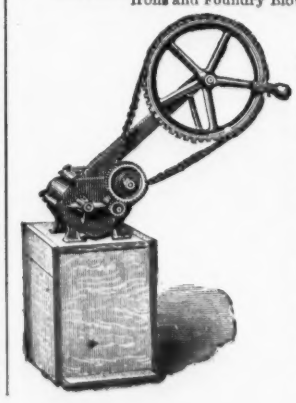

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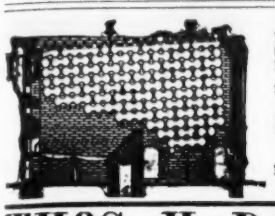

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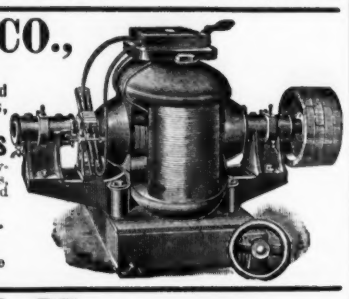

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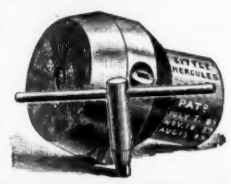

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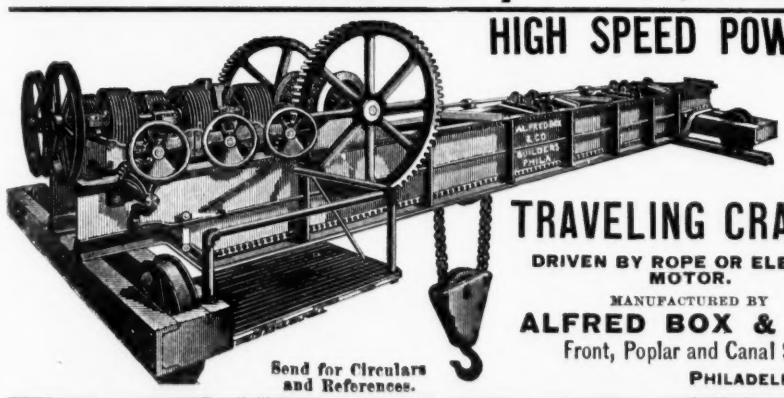

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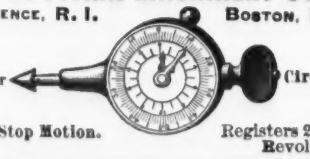
Send for  Circular.

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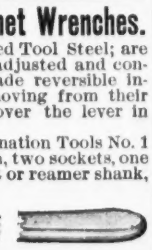

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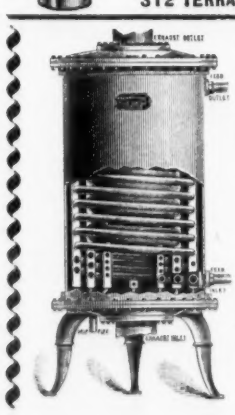

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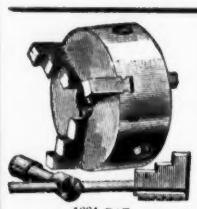

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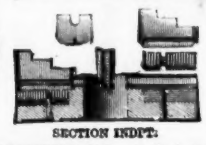

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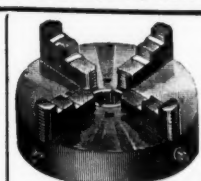

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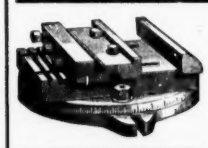

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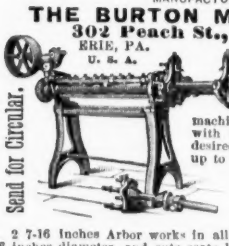

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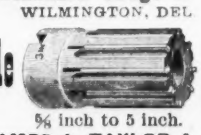
Adjustable  **SHELL REAMERS**

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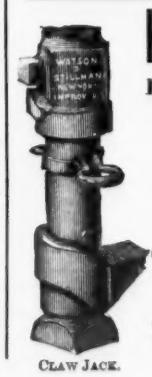

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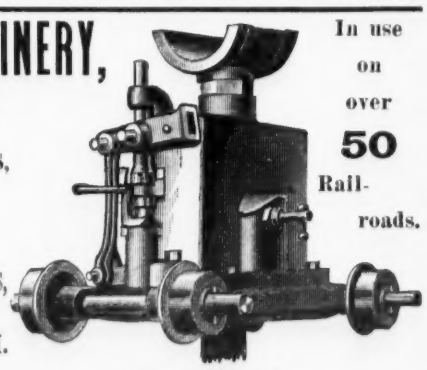

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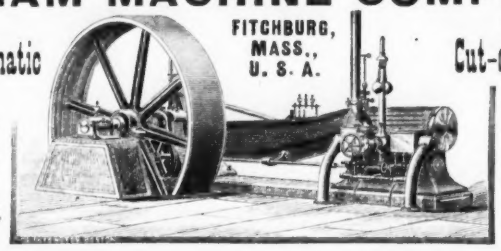

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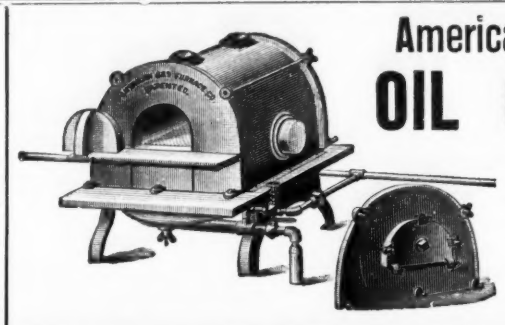

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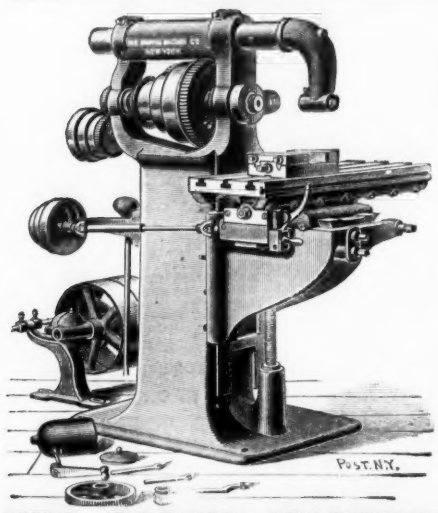

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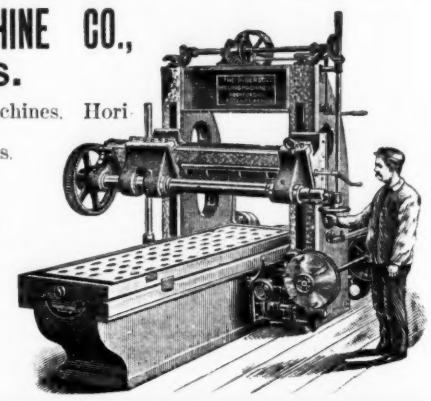

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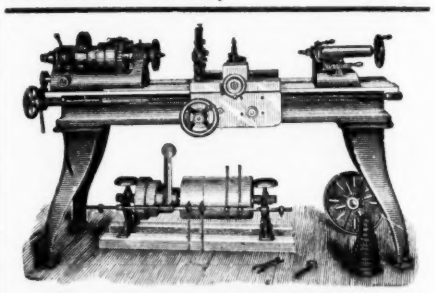

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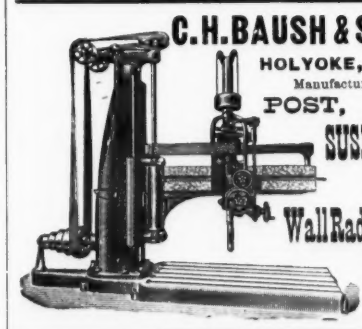

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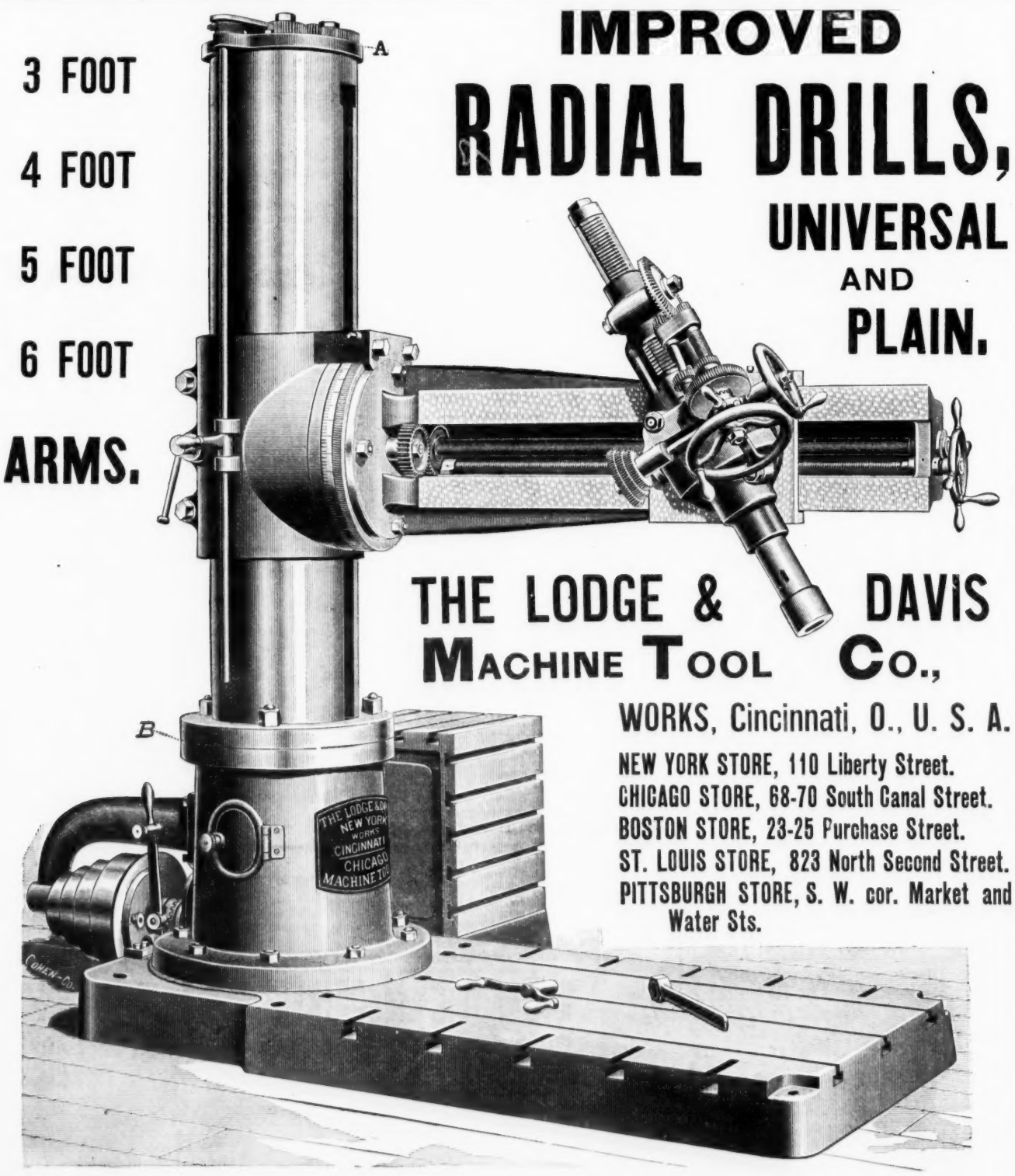

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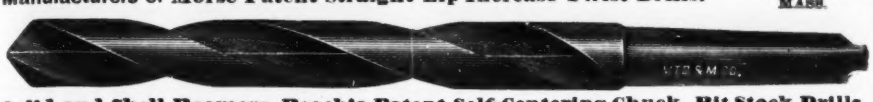

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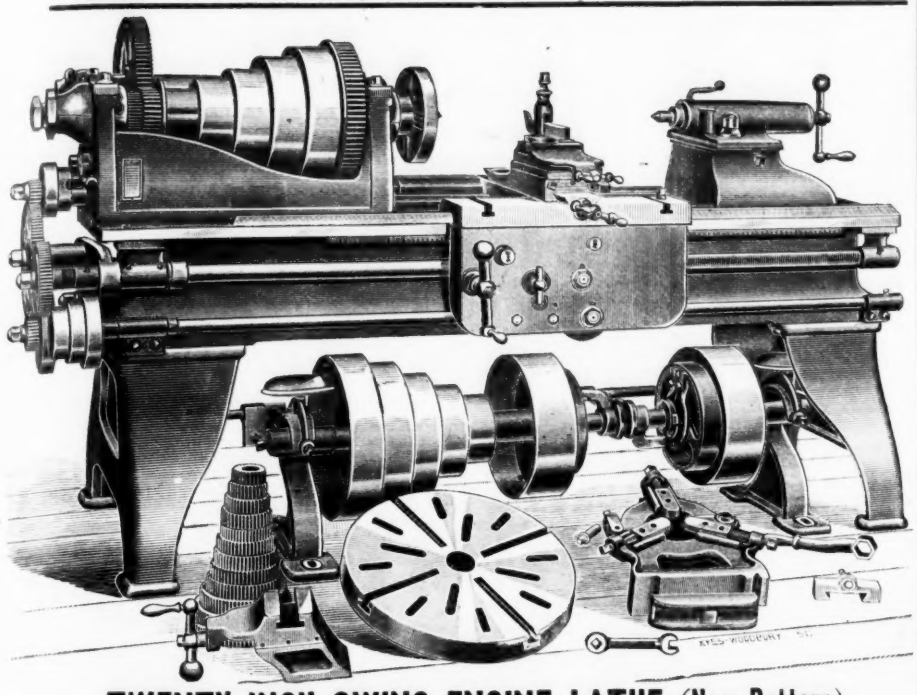

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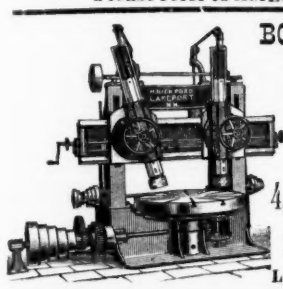

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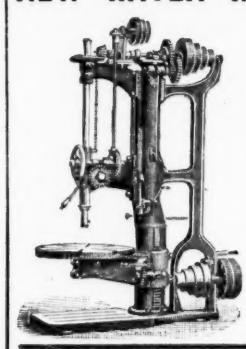

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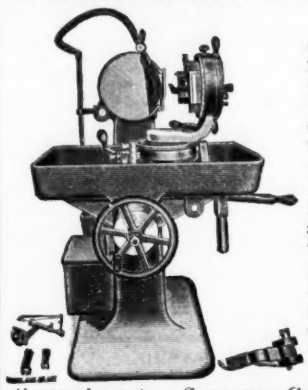

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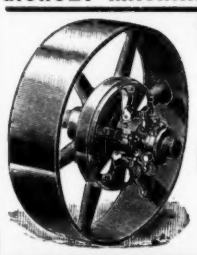

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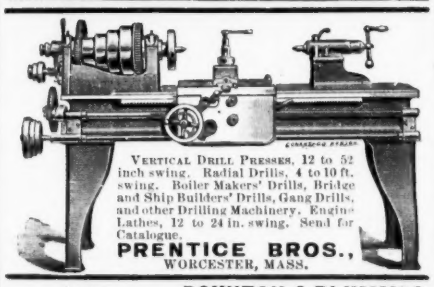

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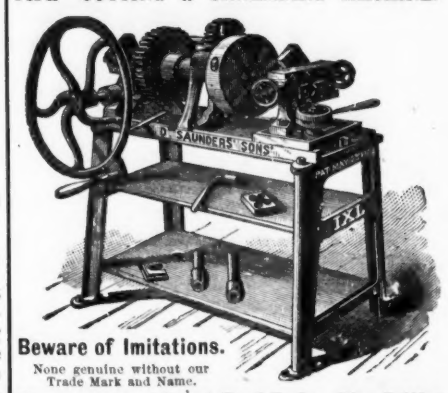

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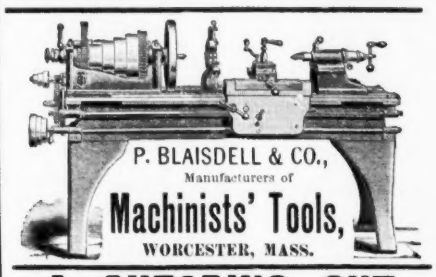

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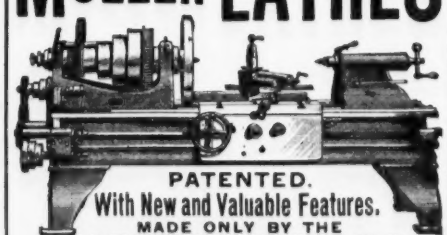

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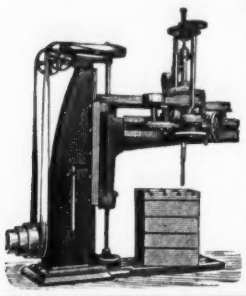

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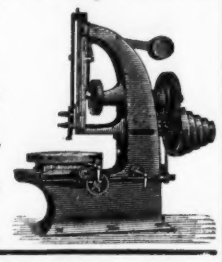

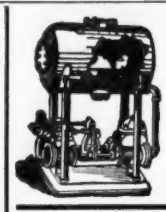

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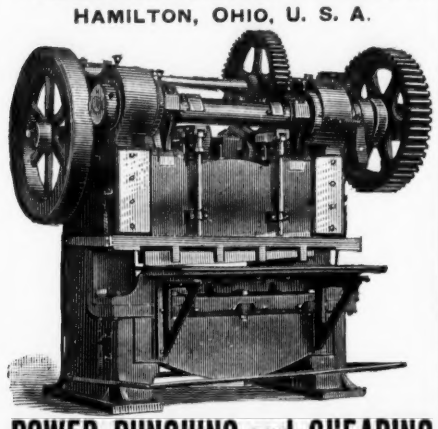

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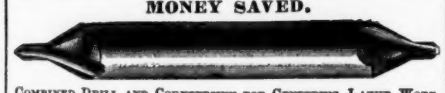

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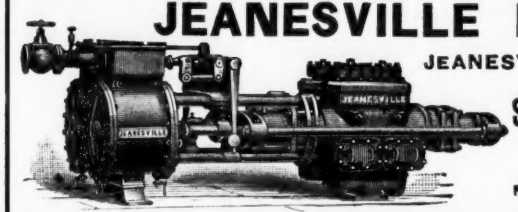

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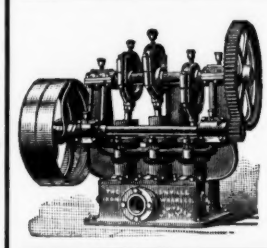

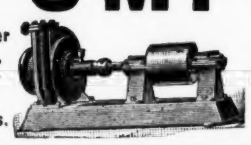

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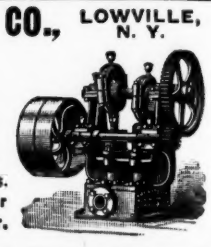

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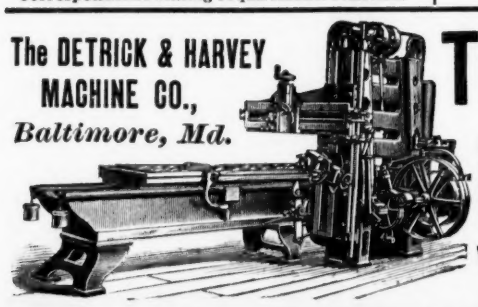

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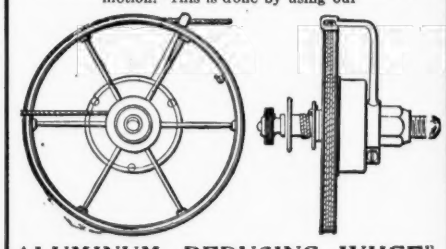

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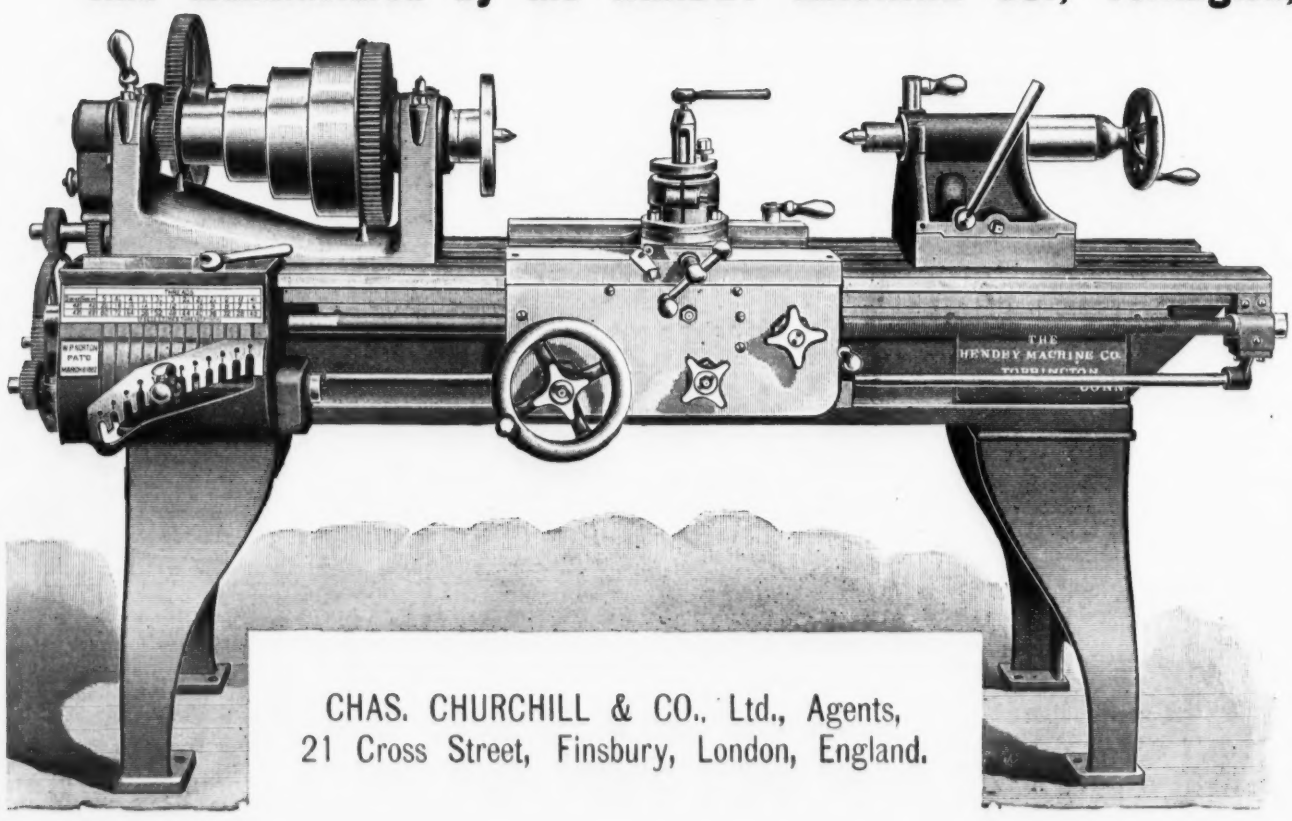

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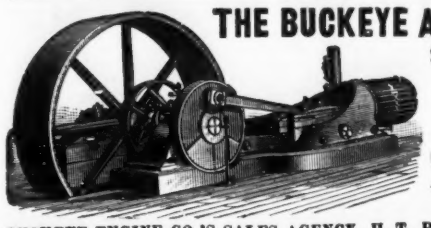

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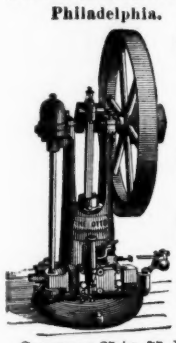

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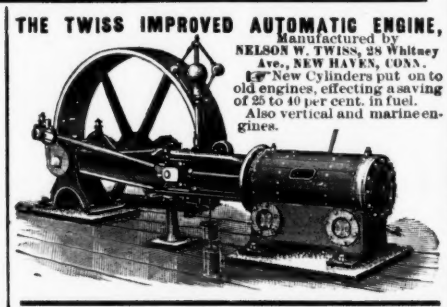

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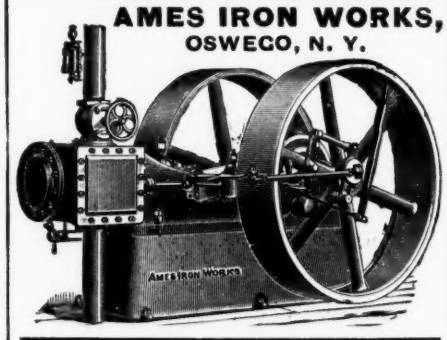

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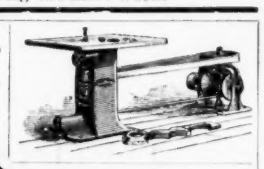

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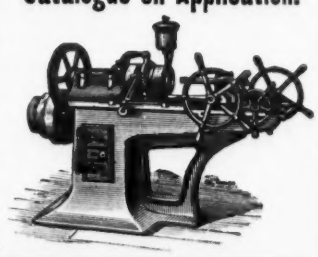

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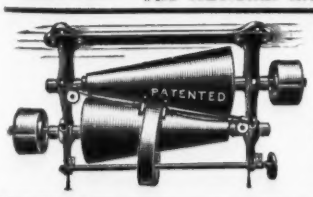

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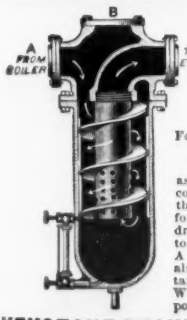

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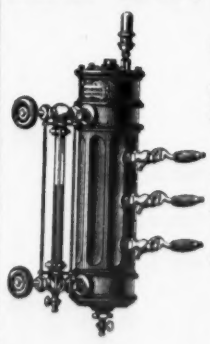

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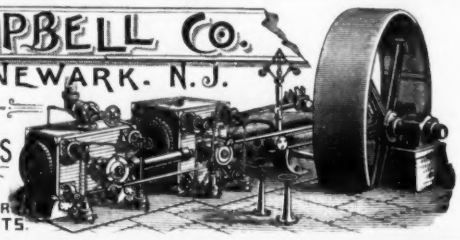

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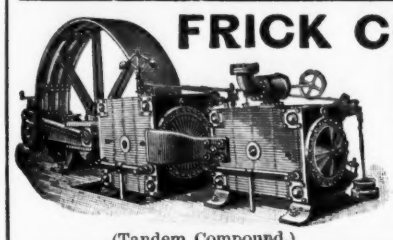

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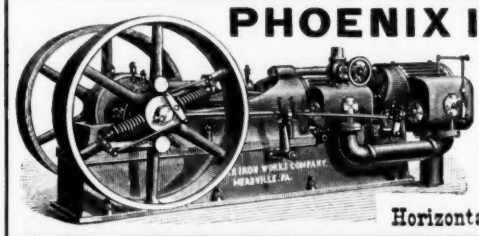

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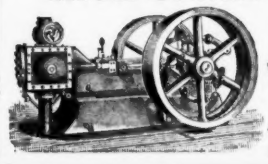

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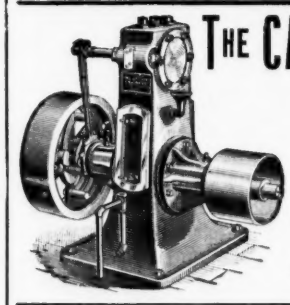

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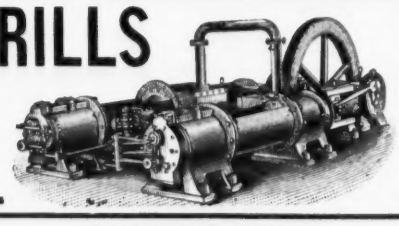

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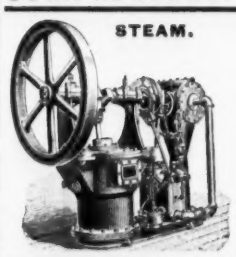

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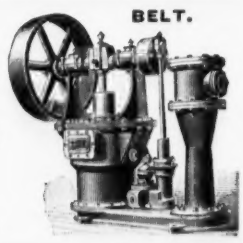

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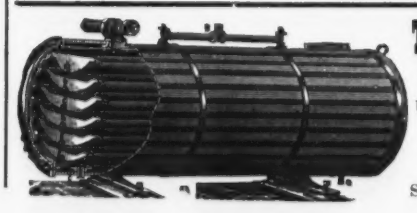

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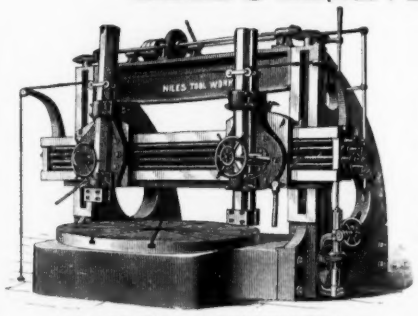

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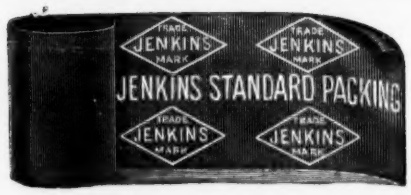

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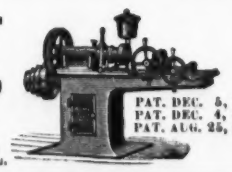

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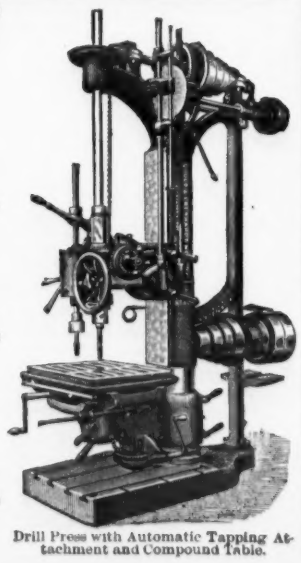

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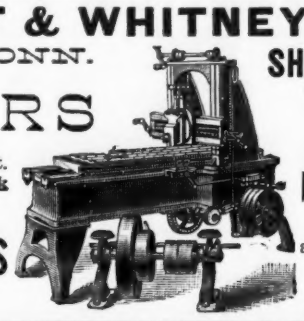

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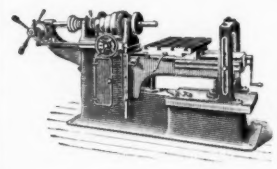

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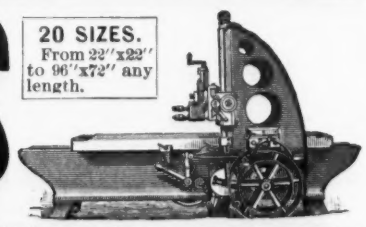

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